Field Guide to the Corals of the Federated States of Micronesia

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A guide to the underwater identification of 80 species of living corals in 24 genera that secrete hard skeletons in the Federated States of Micronesia.

A colony of *Goniastrea stelligera*, Chuuk Lagoon.

All photographs were taken by the author in the Federated States of Micronesia unless indicated otherwise. This is a work in progress, and additional species will be added as photographs become available. This guide presently has about 80 species in 24 genera. There are probably over 400 species of coral in the Federated States of Micronesia. The species directory section is not finished and the introduction is not finished. Parts of the text are the same as in other guides by the author.

To Bert Hoeksema, for all you have done to advance the study of corals.

Other field guides by the same author:

Fenner, D. 2023. Corals of Hawai'I, 2nd Edition: Field Guide, Coral Diseases, Coral Biology, Coral Reef Ecology, Hawaiian Reefs. Mutual Publishing, Honolulu. 400 pages.

Fenner, D. 2022. Field Guide to the Corals of the Marshall Islands. MIMRA.

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Sheppard, C., Fenner, D., and Sheppard, A. 2017. Corals of Chagos. http://chagosinformationportal.org/corals

Fenner, D. 2018. Field Guide to the Corals of the Samoan Archipelago. Pdf.
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Fenner, D. 2019. Field Guide to the Gorals of Fiji. Pdf.
Fenner, D. 2019. Field Guide to the Corals of Wallis. Pdf.
Fenner, D. 2020. Field Guide to the Corals of Wake Atoll. Pdf.
Fenner, D. 2020. Field Guide to the Corals of the Northern Marianas. Pdf.
Fenner, D. 2020. Field Guide to the Corals of Vanuatu. Pdf.
Fenner, D. 2021. Field Guide to the Corals of the Marianas.
Fenner, D. 2022. Field Guide to the Corals of New Caledonia. Pdf.

We stand on the shoulders of giants: this guide would not have been possible without the work of many coral taxonomists who went before me: J.E.N. "Charlie" Veron, Carden Wallace, Bert Hoeksema, Richard Randall, Francisco Nemenzo, John Wells, and Austin Lamberts to name but a few. I thank Lance Smith at NOAA Fisheries' Pacific Islands Regional Office for supporting the development of this guide.

Contents

Corals are presented in the conventional taxonomic order, because it puts corals that are morphologically similar together, which facilitates learning to distinguish them. A few modifications of that order have been introduced to help put similar looking species closer together. The classification based on DNA-sequencing data is presented below this contents listing.

Corals by the New Systematics: DNA-sequencing (PCR) Phylogeny

Here, families are listed alphabetically, genera within each family are listed alphabetically, and species with each genus are listed alphabetically. The species names used are those of the new taxonomy, based on DNA sequencing. There are quite a few changes in which genera species are in and which families genera are in. The old families were based completely on morphology, and morphology had little to base families on. It was impossible to visually identify families. So it is not surprising that DNA sequencing has indicated new groupings of genera into families. What is surprising is that several genera are indicated by the DNA sequencing to be in families that are morphologically very different. So for instance, *Alveopora* which has polyps almost identical to *Goniopora*, is moved from the Poritidae to the Acroporidae to join *Acropora*, *Montipora*, *Astreopora*, *Isopora*, and *Anacropora*, none of which have polyps or skeleton like *Alveopora*. However, under the electron microscope, *Alveopora* is seen to have minute scales on its skeleton like all the other genera in Acroporidae (and a few other species in other genera and families). And, that result has now been replicated using a method that uses much more DNA. Also, the Faviidae in the Pacific and Pectinidae are no more, species in those genera have been moved into the Merulinidae. The faviids, pectinids, and merulinids are all quite different morphologically but all are now in the Merulinidae. The former *Favia* in the Pacific have been renamed *Dipsastrea*, except *Favia stelligera*, which was moved into *Goniastrea*. *Diploastrea* and *Plesiastrea* get their own families. *Montastraea* in the Pacific was divided into *Astrea*, *Phymastrea*, and *Paramontastrea*, which is not surprising, Veron has commented that it seemed to be a collection of different things. The families Mussidae and Echinophyllidae are no more, their species have been moved into a new family, the Lobophyllidae. The morphology of the species in Muissidae and Echinophylliidae are quite different. The genus *Symphyllia* is no more, all the species in *Symphyllia* have been moved into *Lobophyllia*. *Psammocora explanata* and *Coscinaraea wellsi* have been placed in *Cycloseris*, which they don't remotely resemble. *Fungia concinna* and *Fungia repanda* are moved out of *Fungia* which they closely resemble, into the genus *Lithophyllon*, which they don't remotely resemble. Several species in *Fungia* have been moved into *Pleuractis*, and several others into *Danafungia*, and one into *Lobactis*. Only one species remains in *Fungia*, *Fungia fungites*.

Learning to identify corals is less difficult when similar species are compared, and the old taxonomy based on morphology tended to group corals together that had more similar morphology. So the order that corals are presented in this guide is more similar to the old taxonomy than the new systematics. The order of families, genera, and species in the new systematics as shown below is derived from Montgomery et al (2019) which was based on WoRMS (World Register of Marine Species, marinespecies.org). It is said that convergent evolution has produced similar appearances in species that are not closely related, but so far there is no independent evidence for that for most cases with coral taxonomy.

Introduction

This field identification guide was written to help identify corals in the Federated States of Micronesia (FSM). All the photos were taken in FSM, so the photos look like the corals in FSM. Corals look different from each other on a wide range of scales from near to each other to different reefs to different archipelagoes close together to archipelagos very far apart. No species are included in this guide that are not present in FSM, so you don't have to pick your way through many species that aren't in FSM. This is a first version of this and so many corals that are in FSM. are not yet in this guide, but with additional visits by the author more species will be added. The order in which genera are presented is one that has been commonly used in the past (e.g., Veron, 2000) because it tends to put species together that look similar, which hopefully aids learning to distinguish them. The order of genera and species has been modified slightly here to try to put similar-looking species close together in the order, to assist identification.

Fringing reefs typically have two major types of habitats for coral reefs and barrier reefs and atolls typically have four. Both have fore reef slopes, which are on the outside of the fringing reef or barrier reef and slopes steeply at about a 45-degree angle down into the abyss. Another that all three types of reef have is the reef flat: a flat, shallow reef area between the reef crest where the waves break and either the lagoon or the island. A habitat that only barrier reefs and atolls have is the inside slope from the island or reef flat down into the lagoon. And the fourth that barrier reefs and atolls have consists of patch reefs some of which are in the shape of pinnacles, in the lagoon. Lagoons are typically sandy bottomed, and are usually between about 30 m and 100 m deep. There are often patch reefs or pinnacles in lagoons. The fore reef slope typically has wave surge that decreases with depth, and may have currents at times. The reef flat has waves coming across it after they break at the crest, and anything extending above the flat may be exposed to air at extreme low tides. The reef flat on the lagoon side of islands is much more protected than the outer reef flat and thus may have different communities. The slope and patch reefs in the lagoon are protected from open ocean waves and typically have no current. The ring of reefs may have passes where the ring of coral is deeper than elsewhere. Such passes usually have strong currents as water levels outside the lagoon rise or fall with the tides. On rising tides, water rushes through passes into the lagoon, and on falling tides water rushes out. Water on the outer fore reef slope is usually very clear, while that in the lagoon may not be as clear. Each of these zones typically hosts different species of coral, and species that live on one often don't live on the others or are less common on the others. In addition, coral communities are affected by how much wave action they are exposed to. If one side of an atoll has continual heavy wave action and the other side is always calm, there may be quite different coral communities on those two sides. Depth also affects corals, probably from both decreasing light with depth, and decreasing wave surge with depth. Many coral species show some depth zonation, being most abundant at one depth and less abundant deeper or shallower than that. Some may even not be present at some depths. A few species have very wide depth ranges.

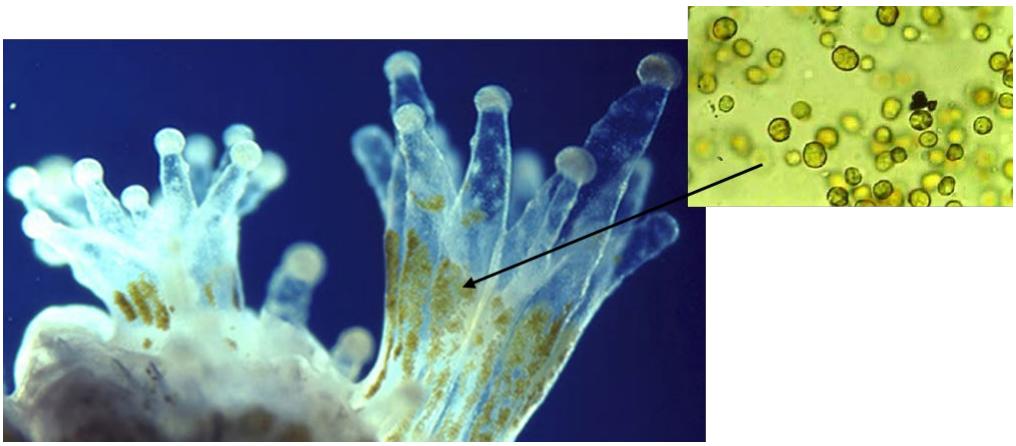
For more background information on marine environments in the Federated States of Micronesia and on coral reef ecosystems and habitats in the Federated States of Micronesia, see Wells, S. (1978), Hasurmai et al (2005), Turak and Devantier (2005), George et al (2008), and Richards (2012). For more information on coral reefs and corals in general, see Veron (1995; 2000), Wallace (1999), Goldberg (2013), Sheppard et al (2018), Sheppard (2021) and Fenner (2022).

Coral Anatomy and Biology: what are corals? Corals 101.

Corals are animals made up of units or modules called "polyps." A polyp is a bag full of seawater, with a thin wall made of 3 layers, an outer layer of cells called the "epidermis," a middle layer of connective tissue called the "mesoglea." and an inner layer of cells called the "gastroderm." The opening of the bag is the mouth, and it is actually turned inside the opening of the bag. There is a ring of tentacles around the mouth. Each tentacle is a hollow tube much like the finger on a glove, filled with water that is continuous with the water inside of the polyp. The water-filled space inside the polyp is called the "gastrovascular cavity" because it serves the function of both a digestive cavity and a circulatory system. Polyps are very simple and lack organs like a heart, blood vessels, and a brain. The gastrovascular cavity has only one opening, the mouth, unlike the tube digestive systems of higher animals, which have two openings and can digest things in a sequence like an assembly line. Anything that is indigestible has to be spat out the mouth. The inner two layers of the body wall project in a series of curtains called "mesenteries" that extend into the gastrovasuclar cavity. Hard corals have ether six mesenteries or multiples of six, and they have as many tentacles as mesenteries. Usually they have multiples of six. Coral polyps vary in size between species, ranging from less than 1mm diameter up to as much as 30 cm diameter.

Corals and their relatives are carnivores, sit and wait predators. They have a remarkable and unique type of stinger in their tentacles, called a "nematocyst." Nematocysts are actually sub-cellular structures inside cells, secreted by the cell, and not alive. They are oval capsules, with a coiled thin tube inside them. The opening of the tube connects to the end of the capsule which touches the cell surface that is exposed to the water. When an animal touches the trigger on the surface of the cell, it provides a chemical that is only found in animals, a short polypeptide. In addition, the movement of the animal provides a mechanical stimulus. Both chemical and movement are necessary to trigger the nematocysts off. Corals and their relatives eat animals. When the nematocyst is triggered, water from the cell moves into the capsule, but the capsule is rigid and does not stretch. So the pressure goes up very high, about that of a scuba tank, the highest in any organism. There are 3 spines inside the tube which are attached to the tube and their sharp points are against the capsule where the capsule touches the cell surface that is exposed to the outside water. The pressure pushes the spines through the capsule wall, releasing the pressure, which then pushes the tube inside out, and outside the capsule and pushes the spines into the prey. The tube has many tiny spines attached inside it, initially pointing inward. As the tube turns inside out like a sock, the tiny spines are thrust out the end where the tube is being turned inside out, and stick into the prey. As the tube turns inside out, then they stick into the prey backwards, holding the tube in the prey. The spines poke into the prey and anchor the tube in the prey, and pull the tube into the prey. The tiny tube is very long, vastly longer than the capsule in which it was tightly wound up. Thus it can go well into the prey. The capsule is filled with a wide variety of nasty venoms, which attack nerve cells, blood and body cells. The end of the tube is open, so it serves as a hypodermic needle, invented by evolution probably over 500 million years ago. The prey is then pushed into the mouth and on into the gastrovasucular cavity by the tentacles. The layers of cells in the body wall have muscle cells in it which can cause the tentacles or body wall to contract. Once in the gastrovacular cavity, the food item is surrounded by the edges of the mesentery curtains, which have cells on the edge which secrete enzymes that digest the prey. The digested juice of the prey leaks out from between the mesentery edges into the gastrovascular cavity and diffuses through it, sped by body wall contractions that move the water inside it, so the juice reaches cells throughout the body wall and tentacles and feeds them.

The gastrodermis also has single algae cells in it, living inside the coral animal cells. They are called "zooxanthellae" which simply means "colored algae cells that live in animal cells." The zooxanthellae are in a group of single cells called "dinoflagellates" which when they are in water, have two flagella (hairs) that beat, one on the end of the cell, and one in a groove around the equator of the cell. When they beat, the cell swims and spins. The cells have chloroplasts in them that have chlorophyll, and can do photosynthesis in light. They also have other pigments that are red, orange or yellow, and together with green chlorophyll they always look brown. When they build glucose sugar in photosynthesis, some of it leaks out into the coral cell and feeds it. Thus, corals have two sources of food, animals they eat, and sugar from photosynthesis. The sugar is high in energy and low in nutrients, and supplies much of the coral's energy needs. The animals that corals eat are mostly small, and called "zooplankton." They provide the nutrients like nitrogen and phosphorus the coral animal cells need. The algae living inside the animal cell gets the waste products of the animal which are nutrients, fertilizer for plants. Plus, it gets a very well defended, stable spot in the sun. This is a mutualistic symbiosis, two different organisms living together, both benefitting, and it produces tight recycling of nutrients in low-nutrient water. The polyps are all connected by continuous tissue, and the gastrovascular cavities are all connected. The nervous system consists of nerve cells connected together like a net, with no brain or ganglion to control it. All the polyps behave as one connected individual coral organism. In addition, the polyps are all genetically identical and all the same sex. Thus, the colony is the individual, not the polyp. Polyps are modules within an individual.



Coral polyps on the left have tentacles. The white on the end of the tentacles and white bumps on the sides of tentacles are large cells called "nematocyst batteries" because they have many nematocysts. (Image: ocean.si.edu) The brownish green spots are zooxanthellae, seen in a microscope photo on the right. (Image: www.captivereefs.com).

Sexual maturity comes when the colony reaches a certain size, not when polyps reach full size. Eggs and sperm are produced by groups of cells which form gonads on the sides of the mesenteries. In a majority of species, the eggs and sperm are released into the water in what is called "broadcast spawning", where sperm from other colonies of the same species fertilize the eggs. The eggs and sperm are released together in egg-sperm bundles, which float to the surface and then break apart. Once the eggs are fertilized, they begin to divide and it takes about a week for them to divide enough to form a little larva, about the size of the head of a pin, called a "planula' larva. It is then capable of settling if it can find a suitable surface. If not, it can continue to float in the water. Over time, if they don't find a substrate, more and more die, and the last ones may live up to 100 days or so. In some places like the Great Barrier Reef, most coral species all spawn on the same night every year. The floating eggs are so numerous there they can form slicks on the surface so large they can be seen by aircraft. Most larvae probably don't go very far, with fewer and fewer going farther and farther with the currents. In other coral species the eggs are retained in the parent and sperm released, and sperm enter through the mouth to fertilize the eggs inside the parent. Then the egg divides and develops into a larva inside the parent, before being released. These are called "brooded larvae." Brooded larvae are able to settle immediately after being released, or they can float with the currents like other larvae. Some brooders release a few larvae every night, with more during some moon phases and times of the year. In addition, a majority of coral species are hermaphroditic, producing both eggs and sperm in one colony. A minority of species have separate sexes. Broadcast spawning and brooding are types of sexual reproduction.

When a coral planula larva settles, it then metamorphoses into a coral polyp of the same, tiny, size. The polyp then grows until it reaches a mature size. The mature size of polyps differs between species. Once the founding polyp reaches the mature size, it starts to divide. It can divide equally into two new polyps. It divides by the two polyps slowly growing and pulling away from each other. But they don't finish the job of dividing, they continue to stay attached to each other by a thin connection. So all corals start out as one tiny polyp which then grows to a mature size and divides into two. As those two grow, they reach the mature size and then they divide into 4. Then 4 into 8, 8 into 16, and so on until there may be hundreds, thousands, or millions of polyps.

Corals also can reproduce asexually, mainly by fragmentation. If something breaks a coral colony, the pieces can survive and grow if they are stable on a hard surface which they can attach to. In some relatively fragile branching species, this is the primary way they reproduce. In other, sturdier colonies, asexual reproduction by fragmentation is rare. Colonies can also have partial colony mortality which may leave islands of tissue living. In that case, as the islands of living tissue grow, they may reach each other and fuse. Only genetically identical tissue will fuse, when different colonies grow until they touch, they do not fuse. All fragments broken off of one colony are genetically identical and can be called "clone mates." Some species like staghorns form extensive thickets of these clones and are called "clonal." Branching corals like staghorns grow fast at the tip and slow on the sides. At the tip, only thin walls are secreted between corallites so the skeleton is highly porous and weak. Then with time the tissue keeps adding calcium to thicken the walls, until low on the branch not only is the branch thicker but it is nearly solid and very strong. If you think about it, leverage means that pressure near the end of the branch produces much more breaking force low on the branch than near the tip. The fact that the low part of the branch is thicker and more solid and thus much stronger, guards against breakage at the base. Thus, it appears that evolution has actually selected branching corals to resist breakage. That is probably because many fragments do not get stabilized on hard substrate and do not survive. Asexual reproduction by fragmentation can come at a high price. Mushroom corals have a few additional variations on these asexual fragmentation themes. When the larva of a mushroom coral settles, the polyp it forms, grows larger and then taller, and then the top surface with the corallte and septa starts widening beyond the stem-shaped part of the corallite. Then the tissue dissolves a crack in the skeleton under the wide top of the polyp. Then only the tissue holds the top on, and something like wave surge breaks the tissue and it falls off. That top that falls off is the shape of a mushroom coral, and grows much larger without ever attaching to anything. In the two species of "*Diaseris*" mushroom corals, the mature corallite dissolves a crack in its skeleton across the disc, and then the two halves are held together only by tissue. Something breaks the tissue and now there are two, half-disc mushroom corals which proceed to regenerate the other half and then dissolve another crack to do it all over again. As a result, those species can form large numbers of clone mate mushroom corals.

Coral polyps are very similar to sea anemone polyps, but reef building corals are usually colonial with several to many polyps, while anemones are solitary with single polyps that can, in some species, grow quite large. Reef building corals can grow large and have many polyps, and they almost always have zooxanthellae. Other corals are usually small, often solitary, don't have zooxanthellae, and live often in the dark, often in deeper water, and those that live in deep water are in very cold water and a few species live in cold polar waters. Reef building corals live only in warm, shallow water and usually live in clear water. Thus, coral reefs are all in warm, shallow water. All corals build what we call a skeleton, made of calcium carbonate. Calcium and carbonate are abundant in sea water, and actually have a higher concentration than needed to precipitate (but precipitate slowly). Corals take calcium carbonate out of the water and secrete it beneath themselves in a single structure that is external, underneath the living polyps, and not alive. So it is different from our skeleton, which have many separate pieces which are inside and have cells in them and are alive (and our skeletons are made of a complex phosphate compound, "hydroxyapatite"). Calcium carbonate can exist in at least two solid forms, one called "calcite" which forms thick crystals, and another called "aragonite" which forms long thin fiber-like crystals. Corals only build aragonite skeletons. After the larva settles on a surface, it secretes skeleton that is cemented to the substrate. Most coral species are firmly attached to hard substrate, but a few are not. Because the skeleton is not alive, it doesn't matter if other organisms like sponges burrow in the skeleton. As long as it doesn't break, it makes no difference to the living coral which is only on the surface of the skeleton. Each polyp sits in a cup in the skeleton called a "corallite." The inside surface of the cup has walls of skeleton that project into the cup and are called "sclerosepta" with "sclero" meaning hard and "septa" means walls. The corallite shape fits very closely to the polyp and reflects all the fine details of the polyp size and shape. The skeleton is much more permanent than the polyp and can retain its shape indefinitely out of water in a museum, and so is used for identification and taxonomy. All the taxonomy with only one exception is based on the skeleton shape. The irony is that a species is a group of living organisms, but we define coral species based on their skeletons, which are not alive. Both the shapes of colonies and the fine details of the corallites and other details of the skeleton, usually observed under a microscope, are used to separate species. Identification of living corals is not definitive, it requires confirmation by examining skeleton. Living corals in the water have some advantages for studying species, since you can see the whole colonies instead of pieces in a museum, and you can see large numbers of colonies, and it is non-destructive. Skeletons in a museum have the advantage that living tissues are not in the way of you seeing the skeleton details, and you can use a microscope, and you can see the same skeletons other people see.

There are a few general things about coral morphology that may be of help to you as you go along. The main unit in coral morphology is the polyp, and the corresponding cup in the skeleton which a polyp sits in. The cup in which a polyp sits is called a "corallite" and includes both the inside and the outside surfaces of the cup. The inside of the cup is called a "calice." There are walls that extend from the inside wall of a corallite into the central space of the corallite, which are called "septa." Each corallite has at least six septa. Septa come in sets, the first set having six septa, the second set also having six which are between the first set of six and usually smaller than the first set of six. The third set is 12 and is in between the existing 12 septa, the next set is 24, etc. In the center of the corallite there is a small structure called a "columella" which may be a single solid column or more often many small columns, or curving, twisted columns. The septa commonly extend up over the rim of the corallite and down the outside surface of the corallite, where they are called costae (costa is singular). Septa and costae may have teeth or granules on the edge and granules on their sides. Corallites can come in many different sizes and shapes. They range in size from about 0.5 mm to about 30 cm diameter. Some are circular, others oval, some quite elongated. Each elongated corallite corresponds to an elongated polyp which has several or many mouths but shares a single gastrovascular cavity. The corallite walls in that case are elongated and usually meander, forming a "meandroid" coral, commonly called a "brain coral." There are many other details.

Coral Identification

Coral species are notoriously difficult to identify. Coral identification and taxonomy are not for the faint hearted. You need all the help you can get. We all do. The purpose of this identification guide is to help you to learn to identify coral species you see in the Federated States of Micronesia. This is a preliminary version of the guide, as the author gets more time underwater and finds and photographs more corals, more species will be added. The goal is to present photographs of the corals taken in the Federated States of Micronesia, and have clear and helpful text that points out the features of the corals that can help in identification and how each species differs from others. One of the advantages of a pdf is that it can easily be updated as often as desired. Another is that photographs can fill the whole screen. The larger the photographs, the better you can see the corals that you are trying to identify. This guide attempts to show both pictures of the whole colony shape, and of close-ups of the corals, and some of the variation between corals. There are valuable identification clues in both the colony shapes and in the features of the corallites and areas in between corallites. You need to be able to see as many of these features as possible to help you identify the corals you see.

At any one reef, only a portion of FSM's coral fauna will be present, and an even smaller portion of that fauna will be common enough that you encounter it frequently. The more often you see a coral, the more chance you have to practice your identification skills. The author recommends looking at the guide as often as possible, including before you get in the water. Then it is good to look again after you get out of the water. Going between the guide and looking underwater, back and forth, is one of the best ways to learn coral species. You will see corals in the water that don't fit well with the species in this guide. You will also see things in the guide that you won't initially see in the water, but with more and more time in the water you will see more and more of them. The author is doing the same thing, finding more species with time spent underwater in more places, and using pictures taken to add to the guide. But a local guide has several advantages over a guide that presents all species from all over the world (such as Veron's "Corals of the World"). For one thing, many of the species in a worldwide guide aren't at your location. That means you have to look through many photos of all sorts of things that aren't on your reef. For another, not all coral species look the same everywhere. Some can look quite different in different parts of the world or on different archipelagoes. Some look virtually identical, but others don't. Most or even all of the pictures taken in a worldwide guide weren't taken in FSM, and so many of them may look quite different than corals in FSM. This guide helps you by only showing you coral species that are in FSM, and only showing you photos of corals in FSM, so the photos look as much as possible like the corals you see.

Unfortunately, there are only a few common names that have been applied to coral species consistently, and most of those apply to groups of corals. So some corals are called "staghorns" and others "table corals" and others "brain corals." But there are several staghorn species and several table coral species. In this guide, similar looking species are presented together as far as possible. Genera are presented in a traditional order, which tends to put corals that look similar together. In addition, within genera corals that appear similar are put together, so all the "staghorn corals" are together, and all the "table corals" are together, and so on. But the species are all labelled with the scientific (Latinized) names, because only those names correspond (as far as possible) to the actual biological species. Common names in widespread use are also given, but usually there are several species that have the same common name. So there is no easy way around using the scientific names.

There are two major reasons that corals are difficult to identify. The first is a naming problem, and the second is a problem of figuring out what group of organisms is the species you are studying. Names are arbitrary human inventions, while the group of organisms is something that exists in nature whether we give it a name or not. We need species names in order to be able to communicate to each other what we are talking about, but the name itself is arbitrary, any name would do, and everybody has a different idea of what name they would like to call it. The solution is a set of rules invented by Carl Linnaeus. You probably know some of the rules. One of the most important is that the first name correctly applied to a species is the one that is correct. This is called "priority." A second rule is that species names must have two words, the first is the genus and is capitalized, the second is the species and is not capitalized, and both are in italics. Any words can be used, from any language, but the words must be Latinized, making them look like Latin. So the word in English, "bushy", taken from a reef in the Great Barrier Reef where a coral was first discovered, was converted to Latin and became "bushyensis" and the species was named "*Acropora bushyensis*". Another rule is that the name and a description of the species must be published. The rule book does not specify where the name must be published. There are other rules, which are contained in a rulebook, "The International Code of Zoological Nomenclature" (which is available online open-access). This is in effect the rulebook for a game played by taxonomists, that is, naming species. There are a variety of problems with this, but one of the worst come from the publications that commonly are used for new species. Very few people are interested in the original descriptions of new species, mostly just other taxonomists that work on the same group of animals, and usually there are only a few of those in the whole world. No widely read journal that publishes papers that many people think are important will publish original descriptions of new species, because almost no one will be interested and read it. So almost all descriptions of new species are published in obscure little journals that almost no one reads, and almost no libraries subscribe to them, since almost no one uses them. One result is that most coral taxonomists have not read most original descriptions, primarily because they can't find copies of them. So many taxonomists have described as new species, species that were described before, sometimes many times. These are called "synonyms", when two names refer to the same species. Taxonomists occasionally write "revisions" of groups of organisms, in which they give new descriptions, and they list all the names that have been previously applied to what is now all considered one species. This requires considerable taxonomic knowledge and skill, because you have to look at lots of old descriptions to figure out which are all the same species. Yet a single species varies between individuals and locations, so original descriptions from different places are often a little different even though it is the same species, and everyone uses different words and sentences, making this a difficult task.

In addition, the rules do not specify which language must be used in original descriptions. At first, most were written in Latin, because that was the scholarly language of the time in Europe where taxonomy originated. Then they were written mostly in a variety of European modern languages, and now most are written in English. Even in English, the language has changed over time, particularly in coral taxonomy. Older publications in English use terms that they didn't define, and which we don't use now. That makes it harder even in English. I have seen an original description of a coral species that consisted of two sentences in Latin. Your Latin better be very good, the whole definition could hang on the meaning of one word in Latin.

Originally there were no samples of the new species, or photographs (photography had not been invented!) or even drawings of the new species. Then people started including drawings in their new species descriptions. The drawings were often made from a particular piece of the species, and slowly those pieces, in a museum, were taken to be "type specimens" that helped define new species. In time, photographs were added. In 2000, the rules were revised to require the description of a new species to include designating a type specimen (usually in a museum). Type specimens are extremely helpful, because if an original description leaves out something that you now think is important, you can look at the type specimen and find out what that is. Further, it is often difficult to imagine what a species looks like from a description. The saying goes that "a picture is worth a thousand words." Of course, we are handicapped by the fact that for the species that were named long ago, there are no type specimens. Another problem is that some old type specimens are in terrible shape. One that Veron has a picture of on his website (Corals of the World) looks like it was dragged behind a car on beach for a couple miles, all the surface is worn off. You can't even tell what genus it is in. This may not be quite as bad a problem as that, most type specimens are not in bad condition. Another problem is that the type specimen doesn't have to be typical of the species, and the original description doesn't either. That's in part because a wide range of samples of a species are almost never available when a new species is being described, and a large collection of samples is needed to determine the variation within the species and what is typical. At this time, for most coral species, we still don't know the range of variation over the geographical range of the species. No one can go to everywhere there are corals and sample many colonies from every site of every species. But we know they vary from site to site. So some or many type specimens may not be typical, and for most species we don't even know whether they are typical or not.

It has been said that the main job of 20th Century taxonomists was to try to clean up the mess left to them by earlier taxonomists. Much of that comes from the arbitrary naming rules, but some comes from the variability in the organisms themselves.

The second great hurdle for recognizing coral species and doing taxonomy on them, is the question of what group of individual organisms comprise a species. This is an empirical question. With some species, it is easy. For *Homo sapiens*, we have the advantage that no other human species is alive today. Our nearest living relatives, chimpanzees and bonobos, are so different from us no one would ever confuse one with a human, and many people don't believe we're related at all. If Neanderthals were alive, it would be much more difficult.

Almost all species ever named and described were named and described based on their morphology and anatomy alone. Originally, only morphology was known and could be included. Plus, morphology until recently has been the quickest and easiest thing to use to describe species. And it makes it possible to identify species in the field. About 1-2 million species of all types of life on earth have been described, but it is estimated that there are 10-30 million species on earth (and other estimates that run from 3 million to a billion; nobody really knows). After about 250 years, we may have only named and described about 10% of the organisms on earth, and we have little prospect of speeding that up substantially. It is not immediately obvious how large the anatomical differences need to be between individuals for them to be different species. There is lots of variation within some species, so something that is different might be a new species or just a variation within a species. How do you tell? Not easy. One thing is that it is helpful to have at least two different features that are different between two species, and that the two go together. So species 1 has features A and B, and species 2 has features a and b. and individuals that have A and b or a and B are rare or can't be found. Another rule of thumb is that in a single feature that has variation between individuals within a species as well as between species, the distribution of that feature (such as length or body weight) has two modes (one for each species) and at least a small gap in between with no individuals. Of course these things require a lot of knowledge about many individuals within a species. That sort of information is very rarely available when describing a new species, but sometimes is available later on when much more is known about the species. Describing new species remains a fairly intuitive thing.

For corals, the morphology that is used in coral taxonomy is the morphology of the skeleton. Originally, the only thing available to taxonomists was the skeleton. Long sailing voyages of creaky old wooden European sailboats went long distances, sometimes around the world. Along the way the crew would pick up all kinds of curiosities, sometimes including corals. Months or even years later, the ship would return to Europe, and by then the coral had long had all the tissue rot off, and only the skeleton was left. If the taxonomist was lucky, the skeleton had not been broken into many pieces or ground against other pieces as the ship rocked. In time, deliberate collecting voyages were organized, financed, and crewed with people whose purpose was to collect. Corals were usually collected by dredging, pulling a dredge behind a boat which broke many corals and gathered many broken pieces of coral. But only within the lifetime of older people living now, has it become possible to dive into the water with scuba gear and view living corals in their natural state. Pieces of coral in museums are exactly that, they are almost always just pieces, and the overall colony shapes usually can't be seen. Further, it is possible now to see large numbers of living, whole colonies underwater, many more than can be seen in museums. Plus viewing corals is non-destructive. I know one coral taxonomist who has collected over 30,000 coral specimens in his lifetime. That is still tiny compared to the hundreds of millions of colonies destroyed by a single, natural, hurricane. But still it is significant. The colony shape of corals is one of the more useful cues that can be used to identify species, but it is usually only available when they are viewed alive on a reef. So viewing corals alive on a reef has its advantages for identifying coral. One disadvantage is that viewing a living coral is ephemeral and in and of itself you usually can't show it to a variety of colleagues. Now, underwater photography fills that gap, and it is possible to show pictures of whole living colonies and close-ups of smaller features to as many people as you wish. Another disadvantage with living corals is that the skeleton on which the taxonomy and secure identification rests, cannot be seen directly, usually, because it is covered with living tissue. The living tissue obscures many of the features you need to use in identification, such as skeletal septa, spines, etc. Further, underwater you can't use a dissecting microscope, your mask fogs up, waves or currents throw you around, you have to do a lot of other things to stay safe like watch your buddy and check your dive computer and air gauge, all the while you are trying not to break coral and to handle the camera and perhaps collecting tools. So there are advantages to working on a piece of skeleton in a lab or museum as well. But it is good to remember that an identification of a coral in the water is a hypothesis, and firm identification requires examination of skeletal samples under a microscope. The present guide is not yet backed up with examination of skeleton under a microscope by the author, but that is planned for the future. Identification of living corals is guesswork, hopefully well educated guesses, which can be checked against skeleton.

Discovering or studying species requires some idea of what a species is. Darwin wrote that many scientists differ in how they define what a species is, they have an intuitive feel for what it is. By now, about 30 different definitions of species have been offered. What I was describing in the previous paragraph is something like a definition of a species based on morphology, which has been called a "morphospecies." Another famous definition is what is called the "biological species". That defines a species as a group of organisms that interbreed within the group, but not with other groups. Reproductive isolation from other species is the hallmark of a "biological species." Reproductive isolation makes sense of some major problem cases for the morphological definition of species. For instance, dogs have enormous morphological variation. The differences between many dog breeds is far greater than that between many wild species. Yet we are sure all dogs are one species. Why? Because they can interbreed freely. Humans also have lots of variation, yet all modern humans are the same species, we can all interbreed. Another problem with morphospecies is illustrated by parrotfish. There are parrotfish that were described as different species because they are different sizes and have different color patterns. But subsequently, they were seen to be interbreeding, they were different sexes of the same species. Many (but not all) species are dimorphic to some degree, with different morphology in males and females. Sexual dimorphism is an example of polymorphism. There are some species, such as some butterflies, that have multiple morphs that look different, but interbreed freely, they are the same species. So the reproductive isolation definition of species handles these problems well. Intuitively we know that reproductive isolation is a better definition of species than morphology alone. However, one problem with reproductive isolation is that it takes a LOT more time and effort to gather the information needed to define species this way than by morphology alone, and we have millions of species left to describe so we don't have the luxury of testing reproductive isolation with each new species (or most of the old species).

There are at least two other major problems with the reproductive isolation definition of species. One is that a majority of all species are extinct and we know them only through fossils. Yet we can't record in fossils which organisms interbreed with each other and which don't. All we have is morphology. Second, there are some species that don't interbreed at all. Rotifers are entirely unisexual and do not interbreed, and have not been interbreeding for about 200 million years, it is thought. Some microorganisms don't interbreed. Bacteria exchange genetic material, but that's not interbreeding in the sense we mean, and bacteria can easily exchange DNA between different species. So interbreeding isn't much help there. In zooxanthellae, interbreeding has never been observed except in the original description of *Symbiodinium*. So it is in some cases not possible to use the reproductive isolation, and in most or almost all cases it is impractical. There is one study with about 20 species of *Acropora* which spawn all on the same night on the Great Barrier Reef, where reproductive isolation was studied. All possible crosses of these species were made, and whether the crosses would produce fertilized eggs. Several were able to cross, including at least one pair of species that had nearly as high frequency of fertilization success and within species. But most did not cross, and most that did cross had fairly low fertilization success.

The newest challenger is of course genetics. It is possible now to quickly get DNA sequencing data from large numbers of samples. One problem is simply handling the enormous volume of information when more than just single genes or small stretches of DNA are sequenced. Interpretation of the results in some cases is not always clear. For many types of animals, there is a relatively small stretch of DNA that is highly variable between species. The DNA sequence in that locus is unique for each species. This is the technique called "DNA finger printing" or "bar coding." If you define a species by morphology and then sequence this locus in the DNA, then you can sequence that locus in many individuals blindly and the results are "fingerprints" or "bar codes" that can identify the species for you. Thus, for the first time, large volumes of samples and species can be separated into species groups without the laborious task of identifying based on morphology. It is easy to sequence large numbers of individuals and use the fingerprints to divide the samples into species. Then matching to databases of known species sequences, you can identify species. You can only get a species name if a taxonomist has identified a species and it has had its DNA sequence fingerprint taken. Further, you have to sample each individual you want to identify, which would be impractical for some types of ecological surveys or monitoring. For most corals, the problem is that there is not enough variation in these markers to separate species (though it may work for genera), and no one has yet found a new stretch of DNA that works. Markers that do work for species have been found for *Pocillopora* and the Agariciids. So genetic fingerprinting doesn't work with all corals at this time, but it does for some. Note that if you compare a DNA sequence for an individual coral with a database, you have to assume that the specimen for which the sequence appears in the database was correctly identified. That assumption may not be warranted for corals, people without significant training in coral ID may get ID's wrong.

The main problem with morphology for corals, is that corals are so highly variable in morphology within species. There is variation at every possible level. Variation between spines in a single corallite. Variation between neighboring corallites on a single colony. Variation between regions (like top and side) of a single colony. Variations between adjacent colonies (in the same environment). Variation between colonies in different zones of the same reef. Variations between reefs, between islands within the same archipelago, between adjacent archipelagoes and between distant archipelagoes. When you're trying to tell two species apart, they both have variations at all these levels, with all the different morphological features they have, all at the same time and perhaps independently. The variation within species is large, and often the variation between species is small. Some studies have quantitatively measured many features in the same individual coral, on the order of 30 or more features, on several corallites or locations of each coral. Do that on more than a few colonies and the work quickly becomes enormous, do it on all the archipelagoes within a species range and it has never been done and may never be done because the work is way out of proportion to the value of the end product, it is too inefficient.

For more on the results of DNA sequencing of corals, see the section after "Contents" on "Corals by the New Systematics: DNA-sequencing (PCR) Phylogeny' and Kitahara et al (2016). For more on the conflict between DNA sequencing and morphology, see Losos et al (2012). For more on the problems of morphological taxonomy with corals, see Veron (1995; 2000) and Veron et al (2022).

Yet we still very much need to be able to identify corals to species, for studies of ecology, monitoring, and conservation. So we struggle along, doing the best we can. My suggestion is to concentrate on enjoying the feeling of accomplishment each time you learn to identify one more species. Don't dwell on the fact that there are many to go, enjoy learning to identify coral species as you progress.

There are a few general things about coral morphology that may be of help to you as you go along. The main unit in coral morphology is the polyp, and the corresponding cup in the skeleton which a polyp sits in. The cup in which a polyp sits is called a "corallite" and includes both the inside and the outside surfaces of the cup. The inside of the cup is called a "calice." There are walls that extend from the inside wall of a corallite into the central space of the corallite, which are called "septa." Each corallite has at least six septa. Septa come in sets, the first set having six septa, the second set also having six which are between the first set of six and usually smaller than the first set of six. The third set is 12 and is in between the existing 12 septa, the next set is 24, etc. In the center of the corallite there is a small structure called a "columella" which may be a single solid column or more often many small columns, or curving, twisted columns. The septa commonly extend up over the rim of the corallite and down the outside surface of the corallite, where they are called costae (costa is singular). Septa and costae may have teeth or granules on the edge and granules on their sides. Corallites can come in many different sizes and shapes. Some are circular, others oval, some quite elongated. Each elongated corallite corresponds to an elongated polyp which has several or many mouths but shares a single gastrovascular cavity. The corallite walls in that case are elongated and usually meander, forming a "meandroid" coral, commonly called a "brain coral." There are many other details.

Useful Terms

The descriptions often refer to "corallites." These are the skeleton cups that the polyps sit in. The word "corallite" refers to both the inside of the cup and the outside.

The descriptions also commonly refer to several different colony shapes. Here are some of the shapes:

Massive = dome shaped, rounded, or hemispherical colonies without deep cracks, but can be any size.

Submassive = appear massive, but there are very deep cracks in it because it is actually branching. The polyps are only on the ends of the branches, and the cracks may not be visible. *Lobophyllia, Caulastrea, Euphyllia*.

Branching = having branches that have side branches and can go in any direction.

Columnar = having near vertical columns that don't branch or don't branch much.

Encrusting = forming a thin crust over the substrate and attached to it, with no space under the coral. Much like paint though not usually as thin as paint.

Foliose = Plate = a relatively thin, nearly flat structure that is thin and has two sides like a plate. Plates are commonly near horizontal but can be at any angle including vertical.

Mushroom coral = resembles the overturned cap of a mushroom.

Staghorn = branching, with branches that look like staghorn (always in genus *Acropora*)

Table = a flat top surface held up by a pedestal which is usually under the center of the table (always in genus *Acropora*)

Digitate = branches look like fingers, without any side branches, not very long, and usually parallel, extending upward from an encrusting base (always in genus *Acropora*).

Corymbose = similar to digitate, but thinner branches, which are often growing up from larger horizontal branches (always in genus *Acropora*).

Hispidose = in the shape of a bottlebrush, with short thin branchlets radiating from a central larger branch (always in genus *Acropora*).

The identifications in this guide are primarily based on Veron (2000); Veron et al (2020); Wallace (1999); Wallace et al (2012); Hoeksema (1989), and Randall and Cheng (1984) and references therein, and type specimens and original descriptions (mostly for *Acropora*).

The words in **bold red** on the same line as the species name are the categories for endangered species. Some coral species have been listed as "threatened" under the U.S. ESA (Endangered Species Act), and some listed as "vulnerable" under the IUCN (International Union for the Conservation of Nature) Red List (www.iucnredlist.org), and some both.

The Corals

Phylum Cnidaria

This phylum contains animals that have a very simple sack-like body with three layers of cells and no organs. The body has a mouth that leads to a water-filled gastrovascular cavity, but the mouth is the only opening to the cavity. It has a ring of hollow tentacles around the mouth, which are extensions of the body wall. The body shape can be a polyp which has an upward facing mouth and the downward end of the body is attached to a surface, or a medusa, which is a jellyfish which is free swimming. In most classes, polyps and jellyfish (medusa) alternate, in one (Anthozoa), only polyps are present.

Class Anthozoa

This class contains animals that have only a polyp stage (no jellyfish = medusa stage). It has two main groups in it, those with exactly 8 tentacles (Octocorals: soft corals, gorgonians, and sea pens), and those with multiples of six tentacles (Hexacorals).

Subclass Zoantharia or Hexacorallia ‘hexacorals’

This subclass contains animals that have six tentacles or multiples thereof: sea anemones, Scleractinia (hard corals), black corals, ceranthid anemones, zoanthids, and corallimorphs.

Order Scleractinia

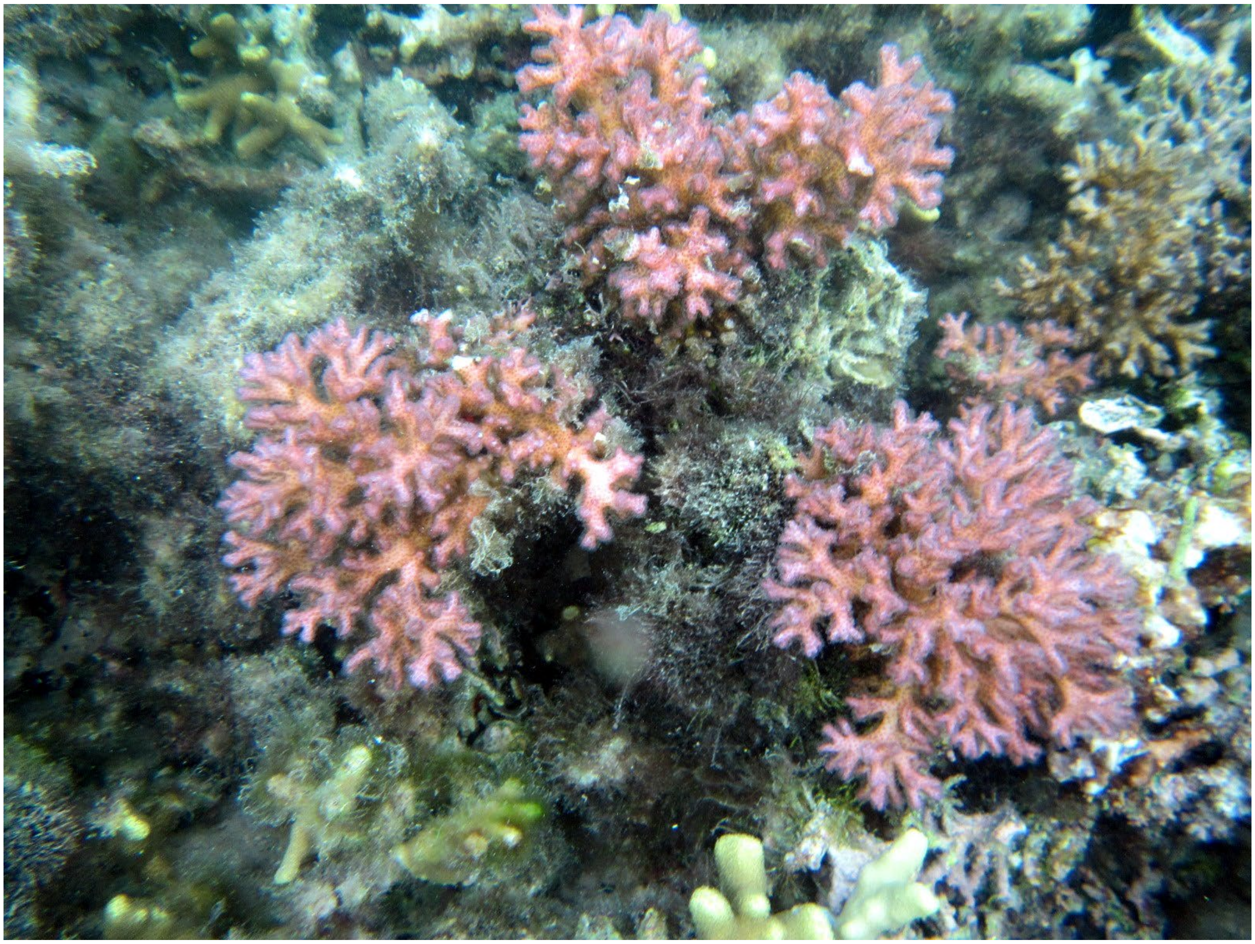
This order contains animals that build calcium carbonate skeletons underneath themselves. In the corallites (“polyp cups”) that polyps sit in, there are “sclerosepta” that are thin walls made of skeleton that project into the calice (the inside of the corallite). This includes almost all of the reef-building hard or stony corals. The reef-building corals have zooxanthellae (single-celled algae inside the coral cells), though there are almost as many scleractinian corals that don’t have zooxanthellae and live in deep, dark, and/or cold water or a few that live in shady locations on reefs. Those that have zooxanthellae are called “zooxanthellate” and those that don’t are called “azooxanthellate.” Most azooxanthellate species are small, many have only one polyp, but a couple of species that live on reefs are large enough to be reef builders (and have many polyps). Most Scleractinia are attached to a hard surface, but a few like most of the mushroom corals are not attached. Most reef-building Scleractinia have multiple to many polyps and corallites, but a few are solitary, with only one polyp. For those that have many polyps, the colony is the individual, and polyps are modules not individuals. In a sense a polyp could be considered an individual, but the polyps in a colony are all connected together with continuous tissue. Further, all polyps are the same sex in a colony, all are genetically identical, and their digestive systems and nervous systems are connected. They reach sexual maturity when the colony reaches a minimum size, not when polyps reach a minimum size. They function and behave as a single individual with modular units, from which a piece can break off and regrow. Polyps vary greatly in size between species from less than 1 mm diameter to as large as 30 cm diameter, and they vary greatly in shape and other details. Colonies also vary greatly in shape, which is helpful in identification.

Pocillopora

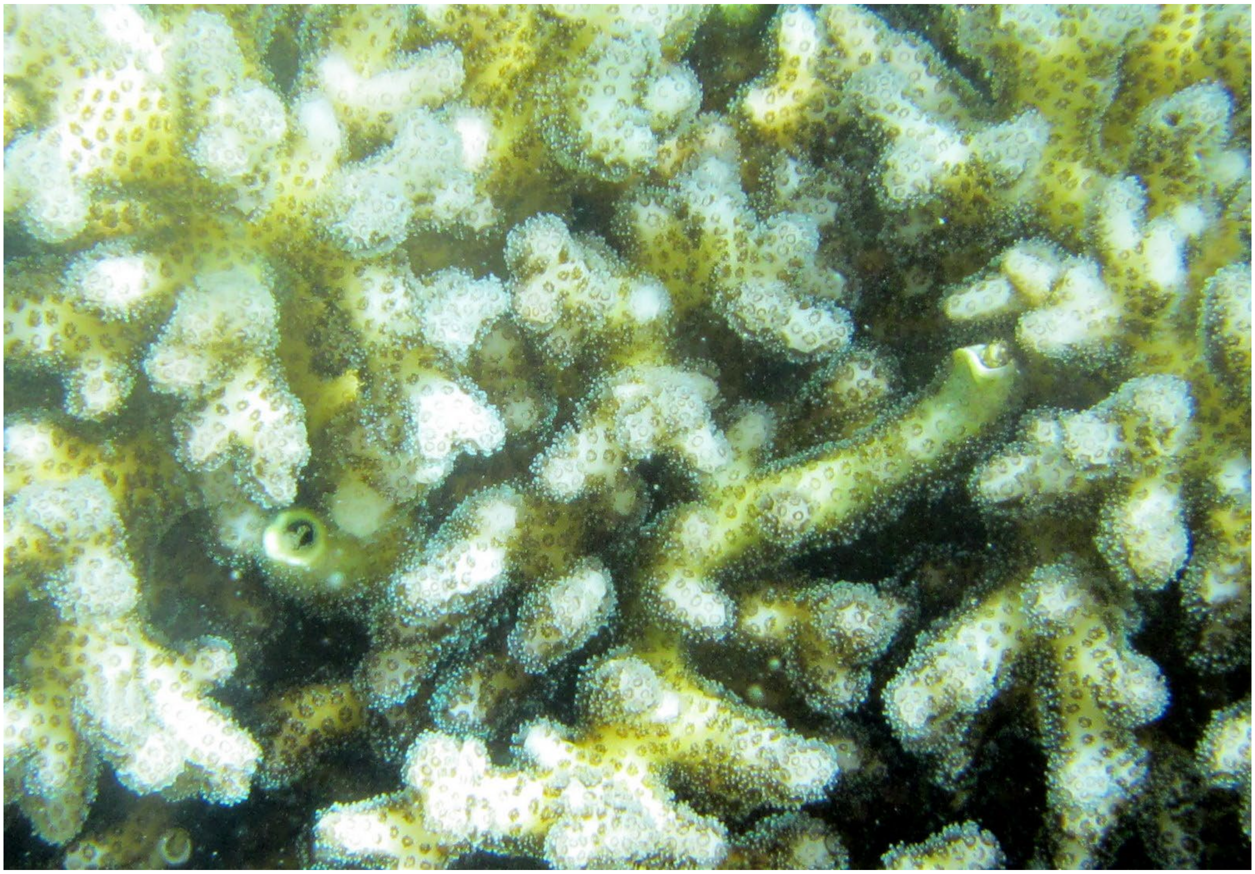
This genus forms branching colonies with tiny corallites about 1 mm diameter. The surfaces of the branches are covered with little bumps called “verrucae” (Latin for blister), about 2-3 mm diameter and tall, and there are corallites all over the bumps and between the bumps. *Stylophora* can have a colony shape similar to *Pocillopora*, but instead of verrucae it has tiny spines.

Pocillopora damicornis

This species forms small branching colonies that have branches that keep branching so that all branch ends are small, about 3-4 mm diameter. Colonies are usually reddish, light brown, or yellow. Other species of *Pocillopora* have branches that are thicker than the verrucae.



Pocillopora damicornis.

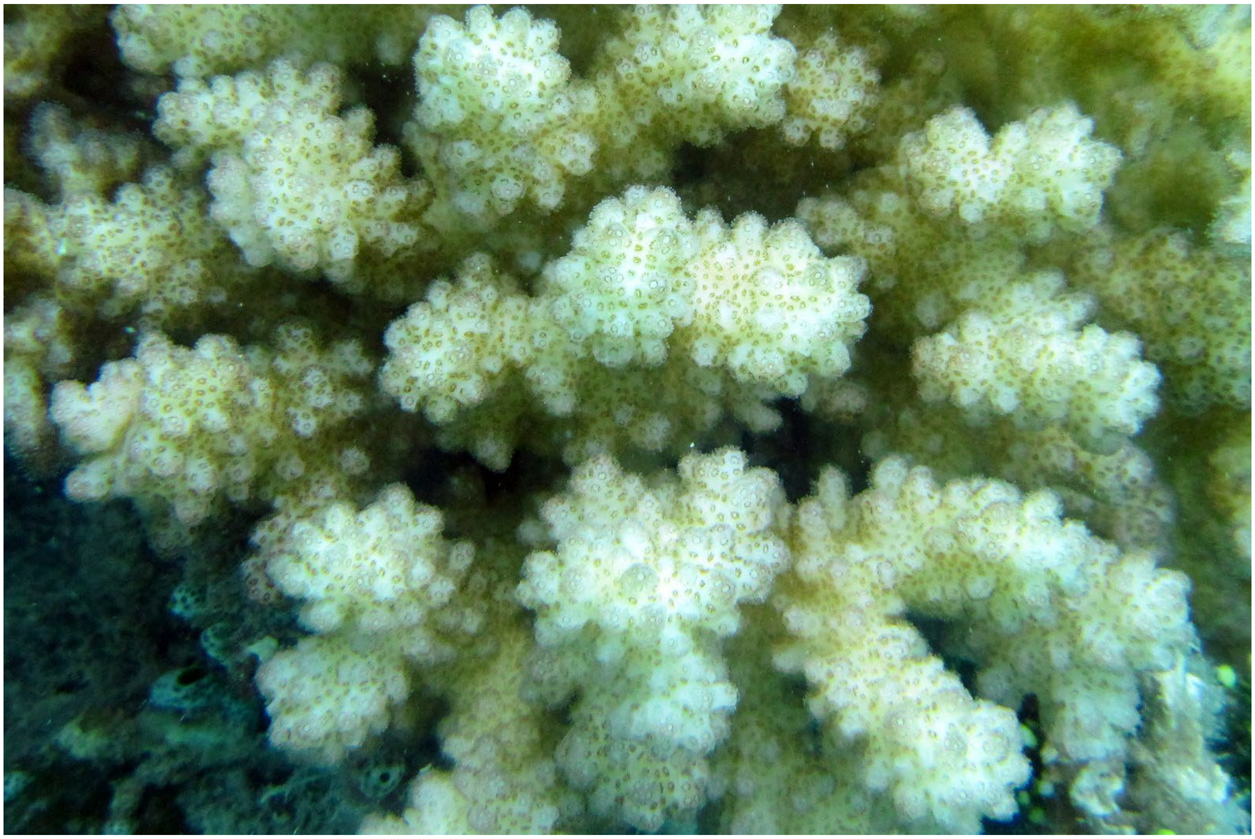


A close-up of a yellow colony of *Pocillopora damicornis*. The spots are corallites, and the fuzz are extended tentacles.

Pocillopora verrucosa

This species forms small colonies with thick branches, most of which are cylindrical or nearly so. The branches are much thicker than the little bumps on the branches, so the branches and bumps are very distinct from each other. The branches are larger than on *Pocillopora damicornis* and they are not flattened like on *Pocillopora meandrina*.

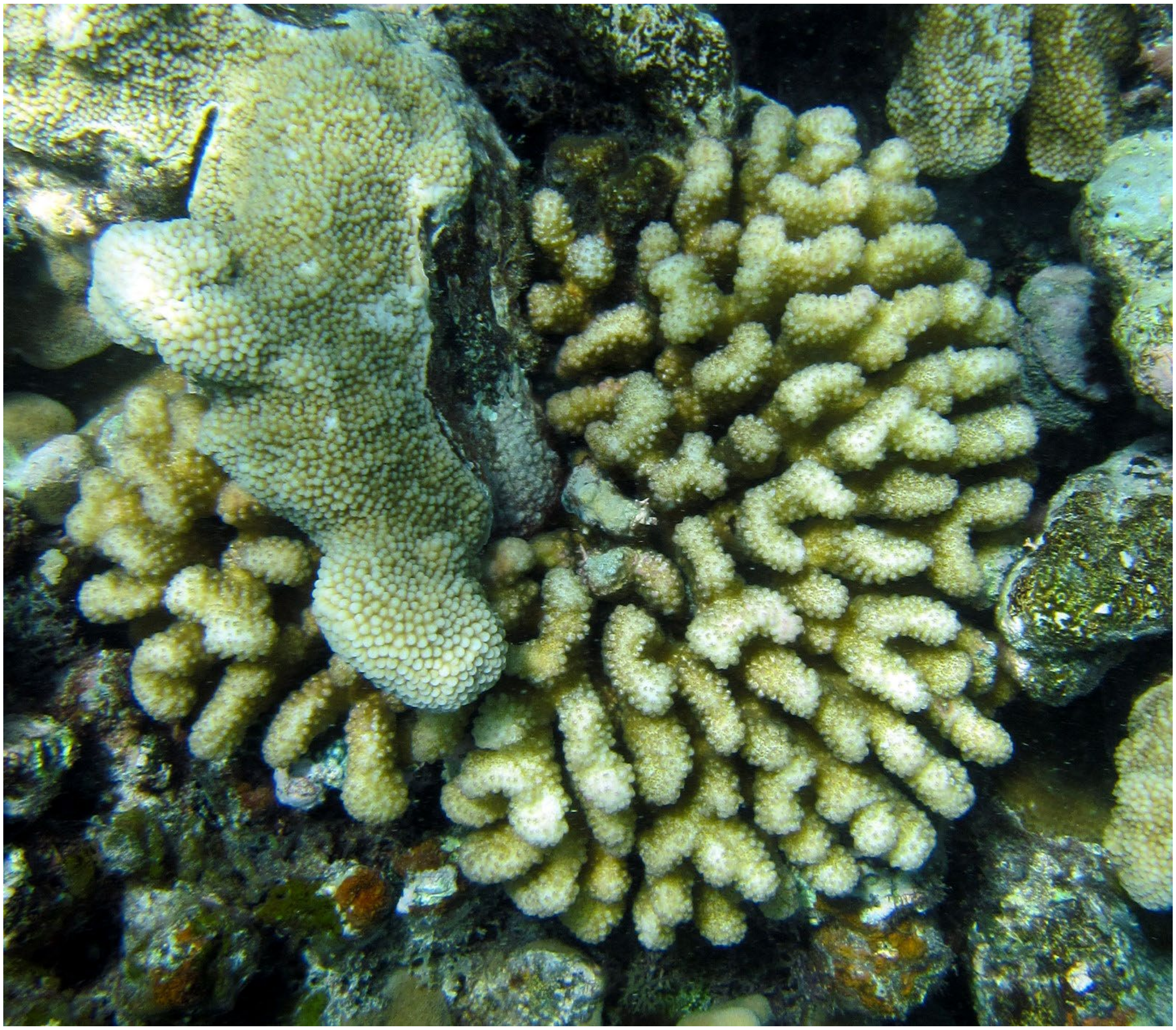
A colony of *Pocillopora verrucosa*.



A close-up photo of *Pocillopora verrucosa*. The tiny brown circles are polyps, about 1 mm diameter.

Pocillopora meandrina

This species forms branches that are much larger than the little bumps on them. Some or many of the branches are flattened and some are curved. Colonies are usually less than a foot and a half in diameter. The branches are more flattened than on *Pocillopora verrucosa*.

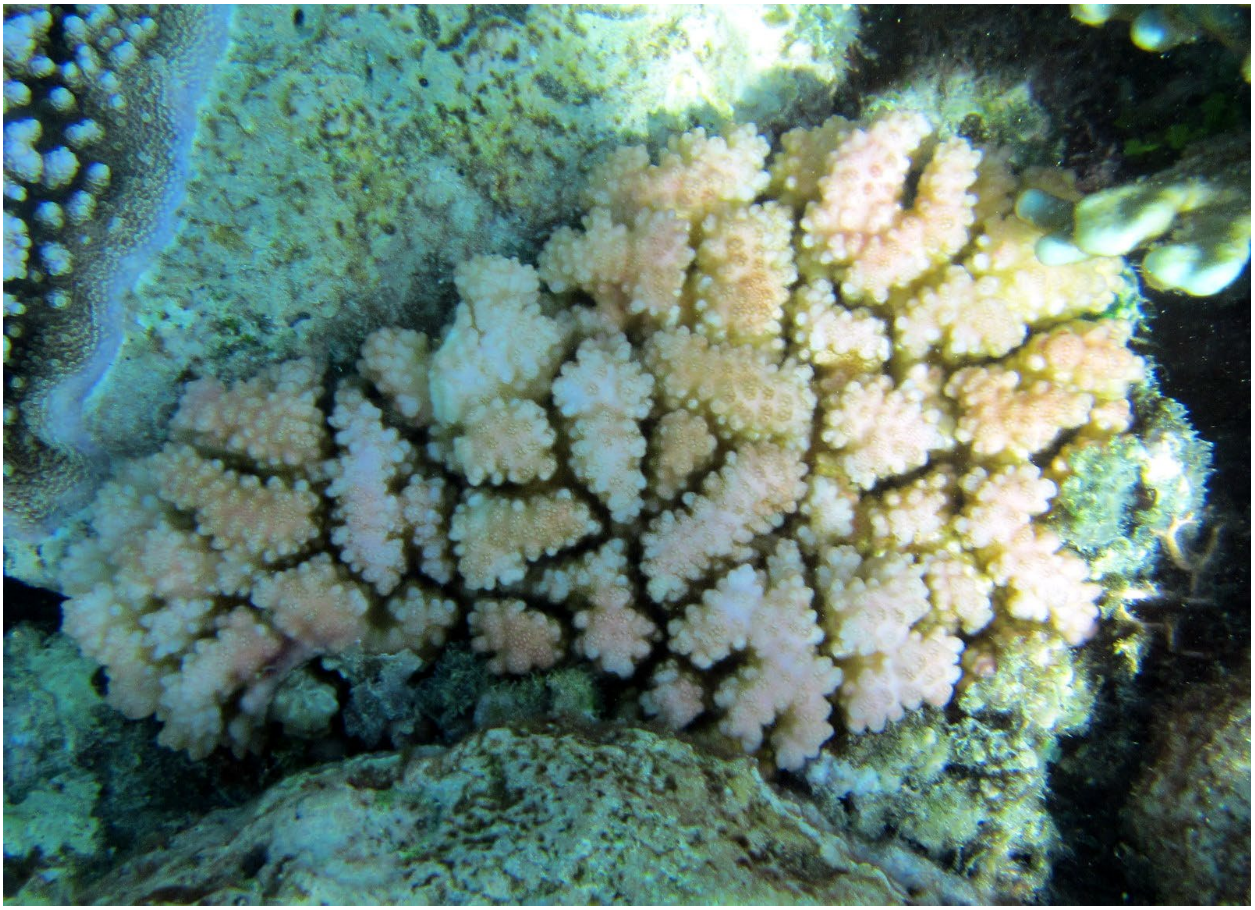


A colony of *Pocillopora meandrina*.

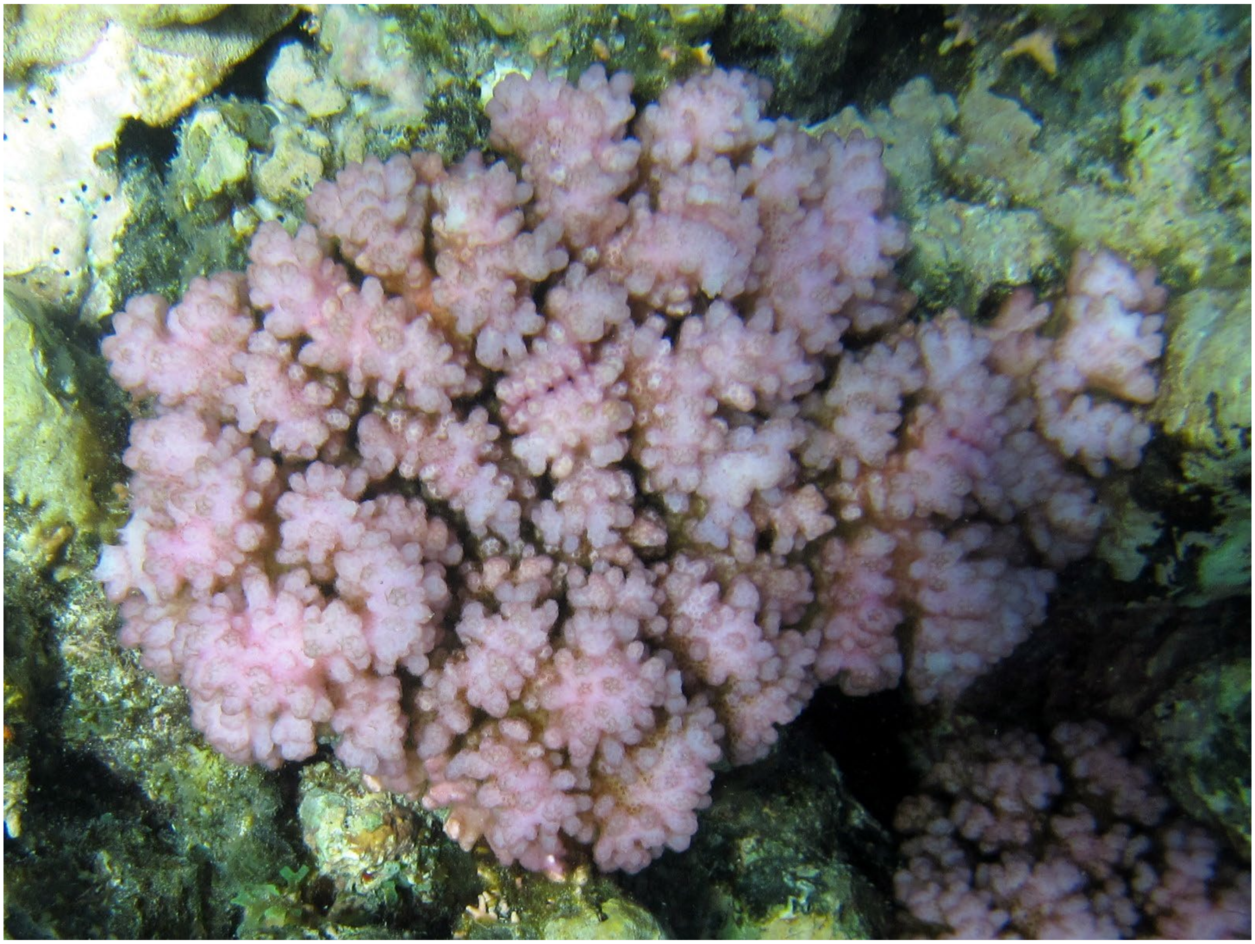
A close-up of *Pocillopora meandrina*. The bumps can easily be distinguished from the much larger branches.

Pocillopora setchelli

This species forms colonies with branches very close together. Colonies are less than a foot diameter. Colonies are only in shallow water. Branches are closer together and shorter than on *Pocillopora meandrina*.



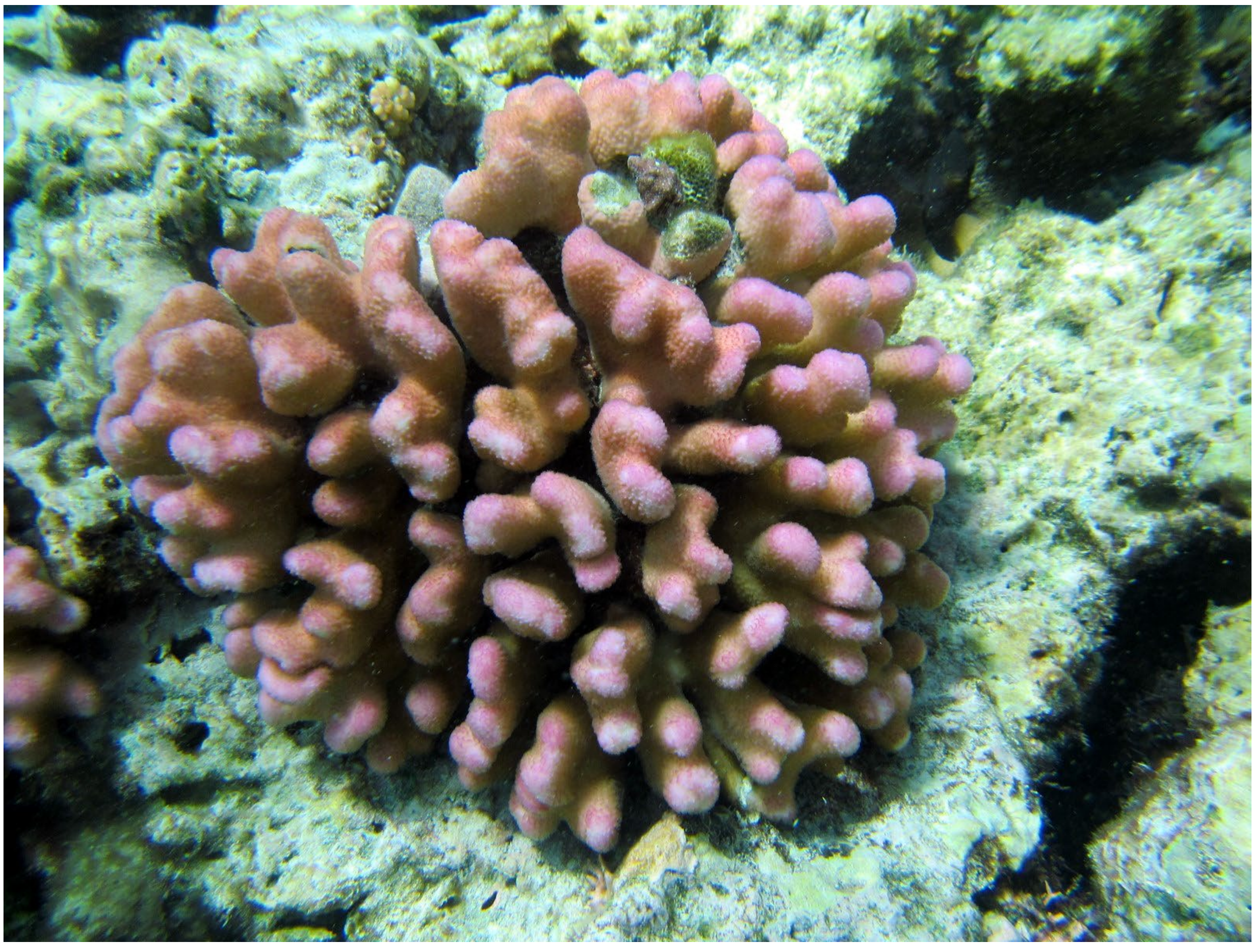
A colony of *Pocillopora setchelli*.



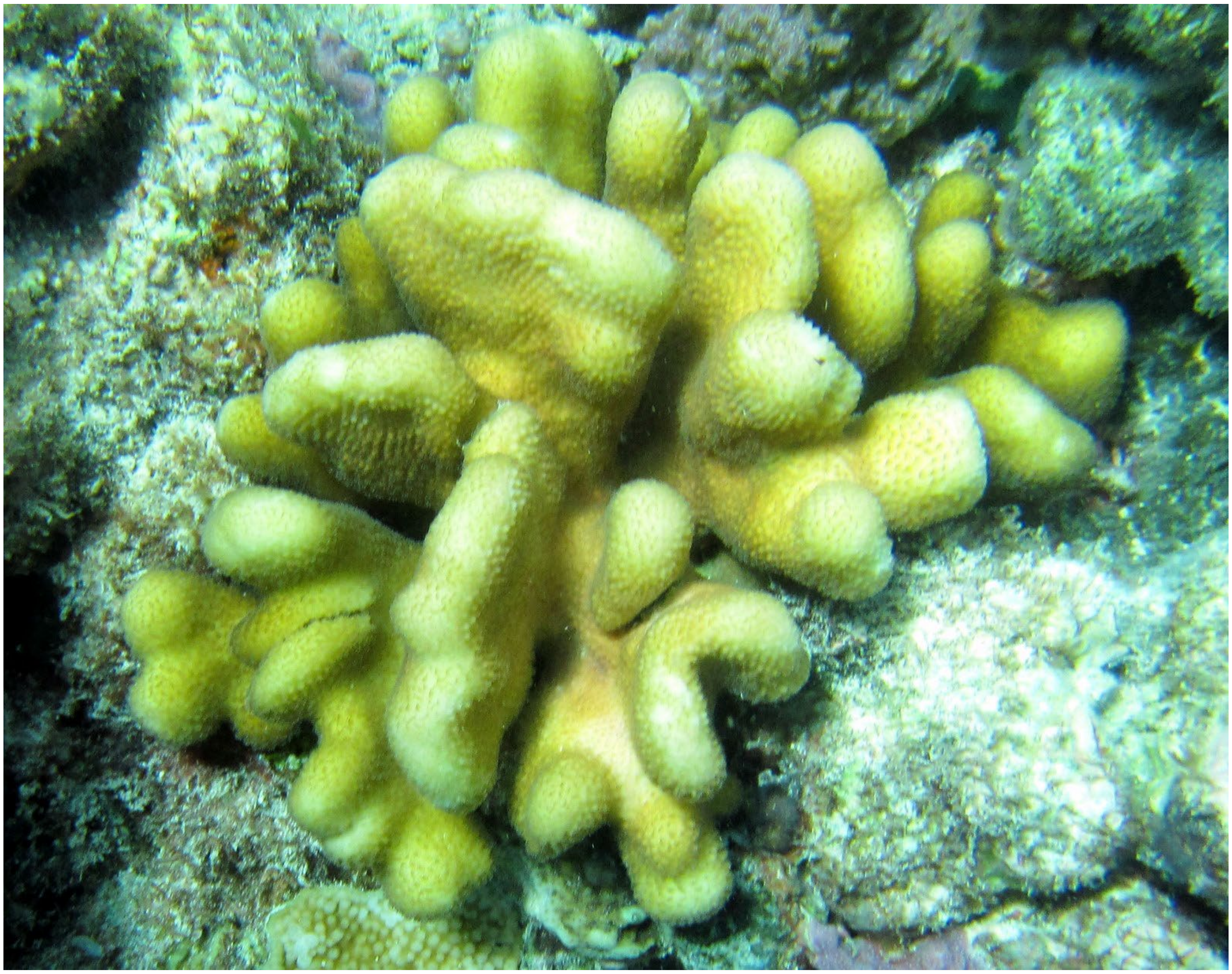
Another colony of *Pocillopora setchelli*.

Stylophora
This genus forms branching colonies which have tiny polyps and corallites. There is a tiny hood that projects over each polyp. The hood is pointed so they look like spines. *Pocillopora* can have a similar colony shape, but has verrucae (bumps) that are much larger than the spines on *Stylophora*.

Stylophora pistillata
This species forms branching colonies with branches that are about the diameter of a thumb, and which may be flattened near the end of the branches. Colonies are usually less than a foot and a half diameter. The spines on the branches may be visible, but they are much smaller than the bumps on *Pocillopora*. Colonies can be pink or yellow.



A colony of *Stylophora pistillata*.



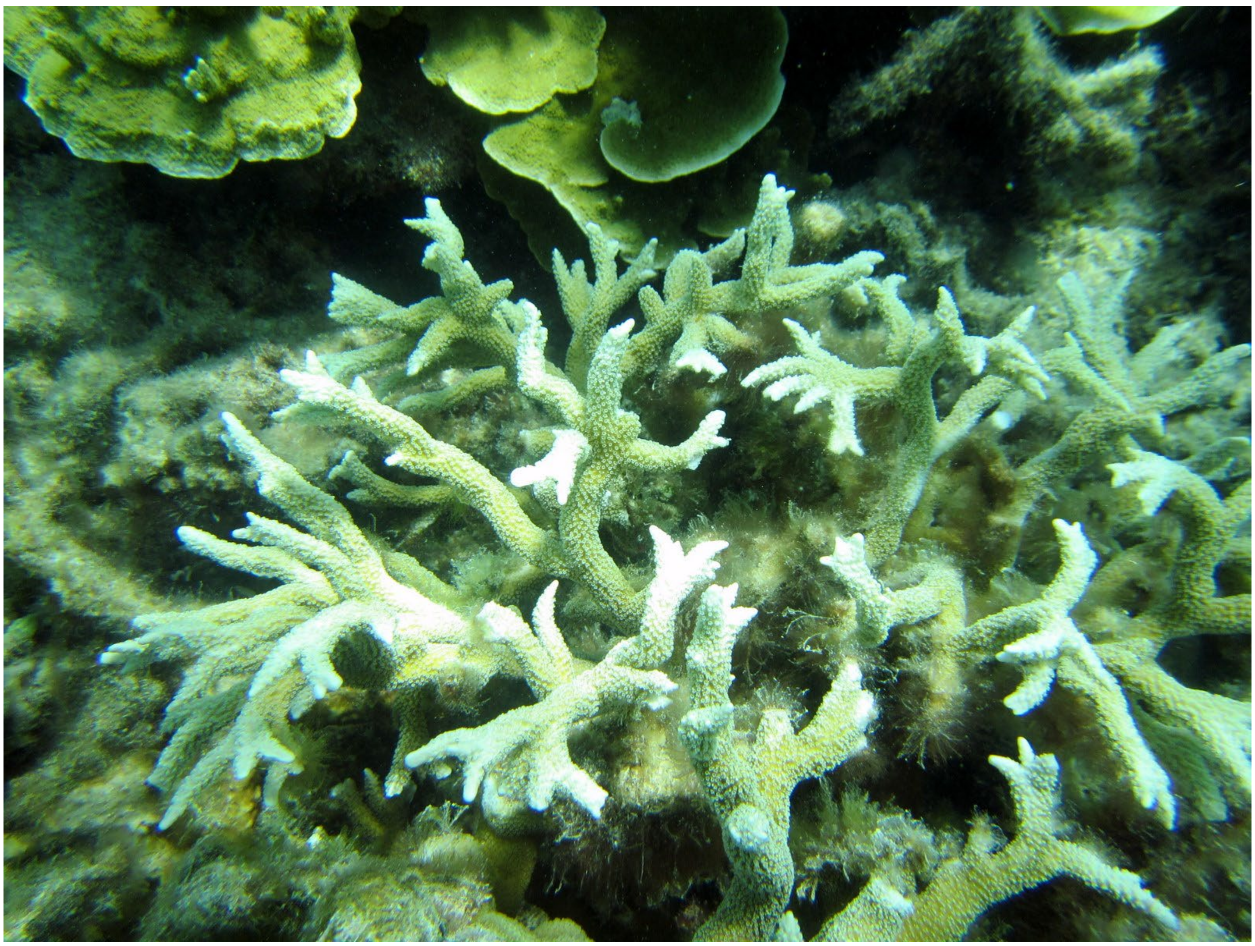
A yellow colony of *Stylophora pistillata*. The spines are just visible in this photo. They can also be felt.

Montipora

Montipora has tiny corallites, about 1 mm diameter. It has colonies that have a variety of shapes, from encrusting to plates to massive to branching. The surface can be covered with tiny spines called "papillae" or have rounded smooth bumps called "verrucae" (Latin for blister) which are larger than corallites, or have neither of these. When it has branches, the branch tips have no corallites on them. *Montipora* is the second largest genus of reef corals, with over 75 species. *Porites* can look similar to *Montipora*, but *Porites* does not have spines and usually *Montipora* has spines or bumps between corallites. Also, corallites are usually close together on *Porites* and not on *Montipora*.

Montipora digitata

This species forms branching colonies with branches about the diameter of a finger. The branches have smooth rounded tips with no polyp or corallite on them, unlike *Acropora*. Polyps may be visible on the sides of branches, but spines are not obvious like they are on *Montipora stellata*.

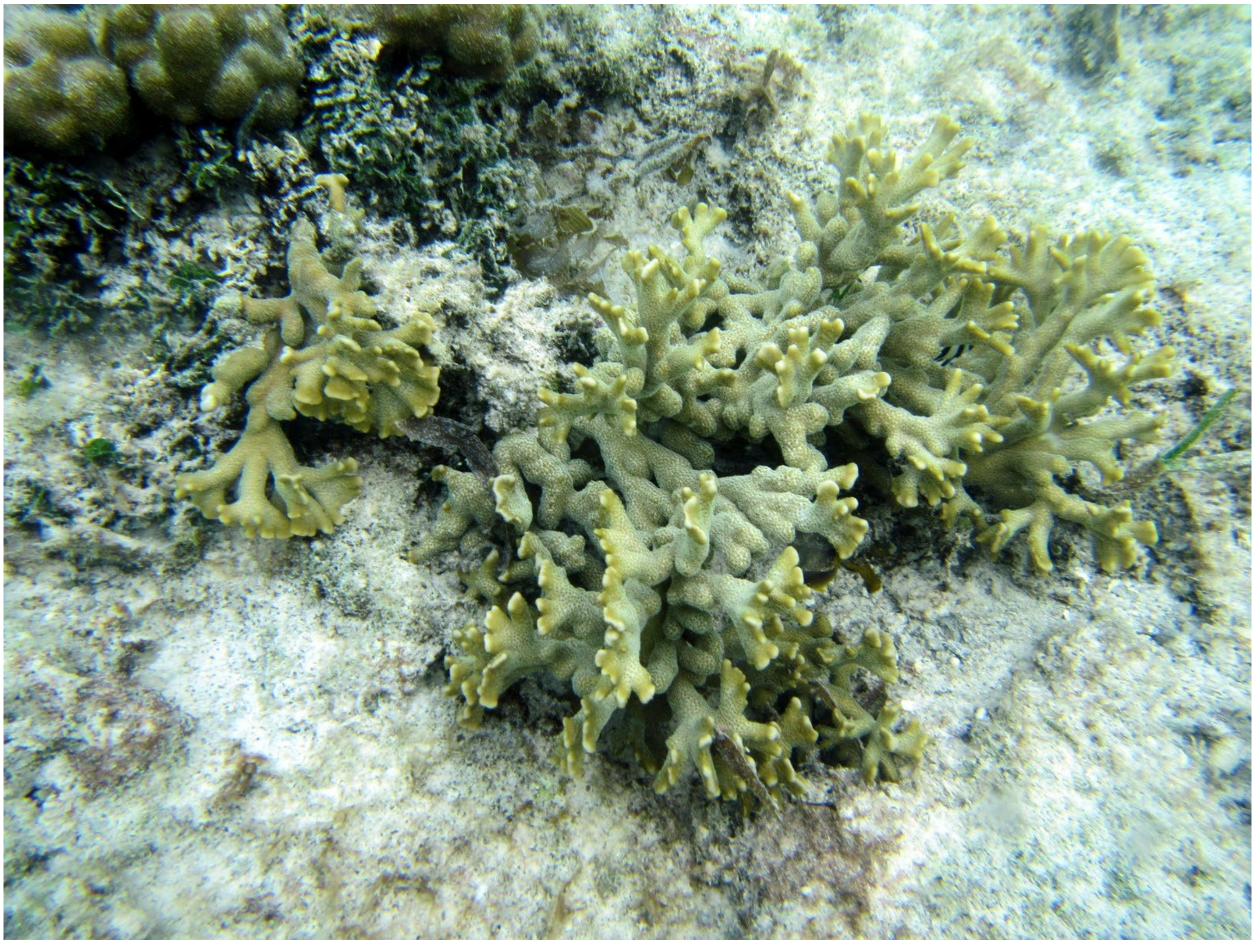


A colony of *Montipora digitata*.

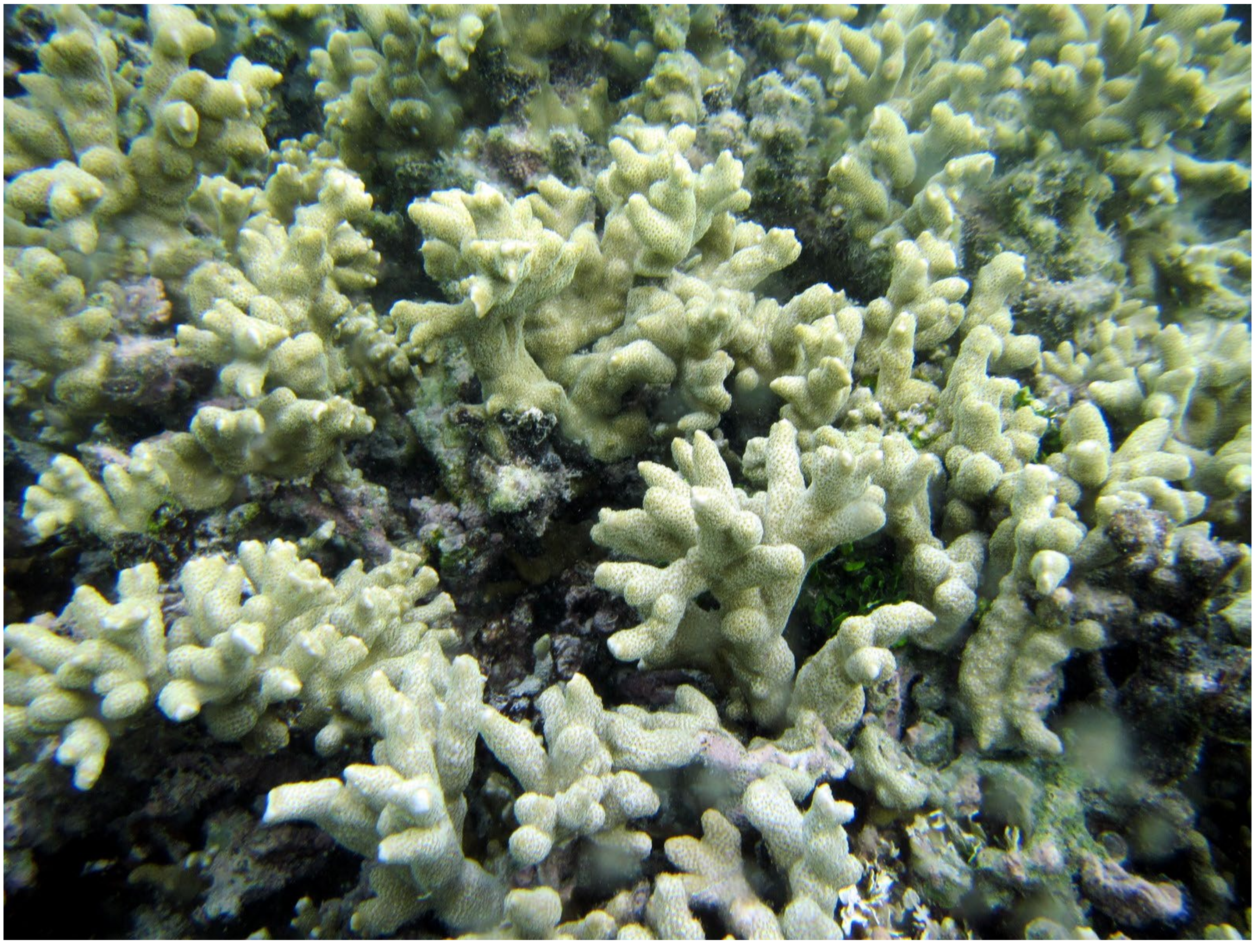
A close-up of a colony of *Montipora digitata*. Note the polyps (rings of tentacles) and the round smooth branch tips.

Montipora altasepta

The species forms branching colonies with branches about the diameter of a pencil (5 mm or so). The branches are cylindrical, and may branch often. Branch tips can be flattened or fairly sharp. There is no axial corallite on the end of a branch, the branch tip is smooth. Polyps often have their short tentacles extended. In some places there are tiny rounded lumps of skeleton between polyps. Found on reef flat. Light brown to green. *Montipora digtata* does not have bumps between corallites.



Montipora altasepta.

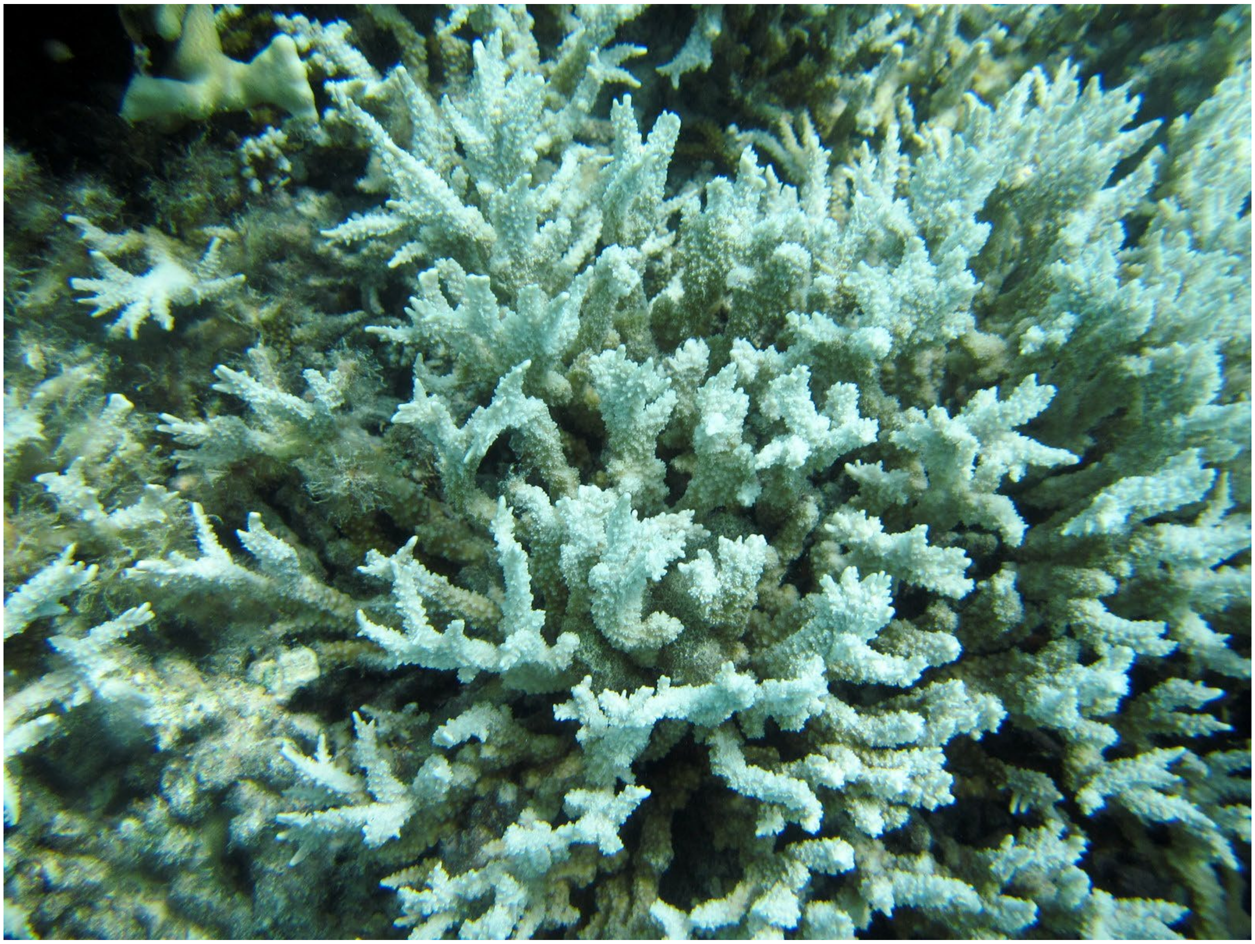


Another colony of *Montipora altasepta*.

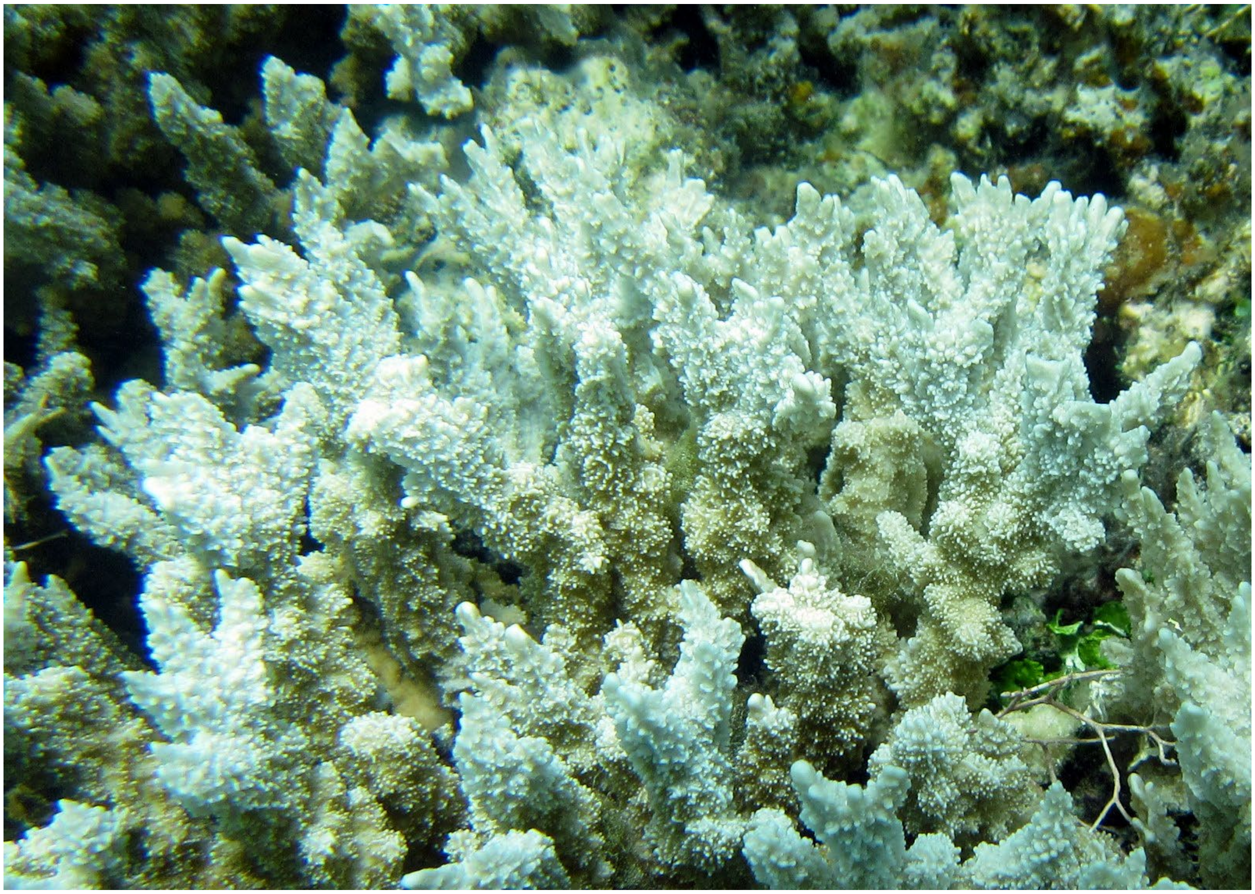
The tiny bumps between polyps can be seen here in this close-up photo, but would be hard to see underwater.

Montipora stellata

This species forms thin branches, no thicker than a pencil. The branches have spiny sides and smooth tips. The branches are more irregular and spinier than on *Montipora digitata*.



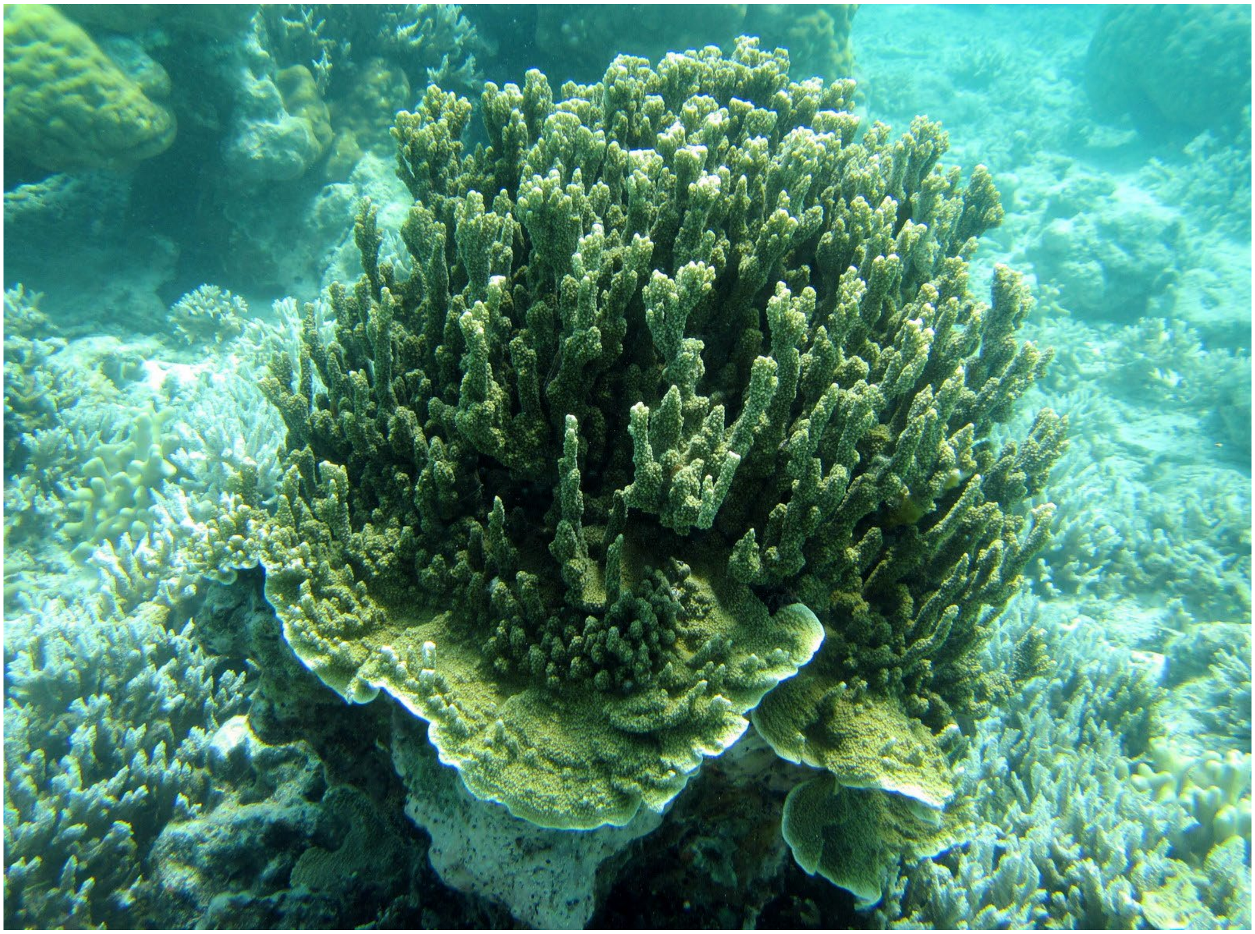
Part of a thicket of *Montipora stellata*.



A close-up picture of *Montipora stellata* showing the spiny, bumpy surface.

Montipora hispida

This species forms colonies that commonly have a thin plate base with thin, nearly vertical columns. The columns are about the width of a pencil. They often vary in height and may branch to form more columns. The colonies are usually brown. Few other *Montipora* have both thin plate bases and thin columns.



A colony of *Montipora hispida*, Chuuk Lagoon

A close-up photo of *Montipora hispida*. The polyps are often extended. Sometimes the columns are very short.

Montipora cf. *hodgsoni* Vulnerable

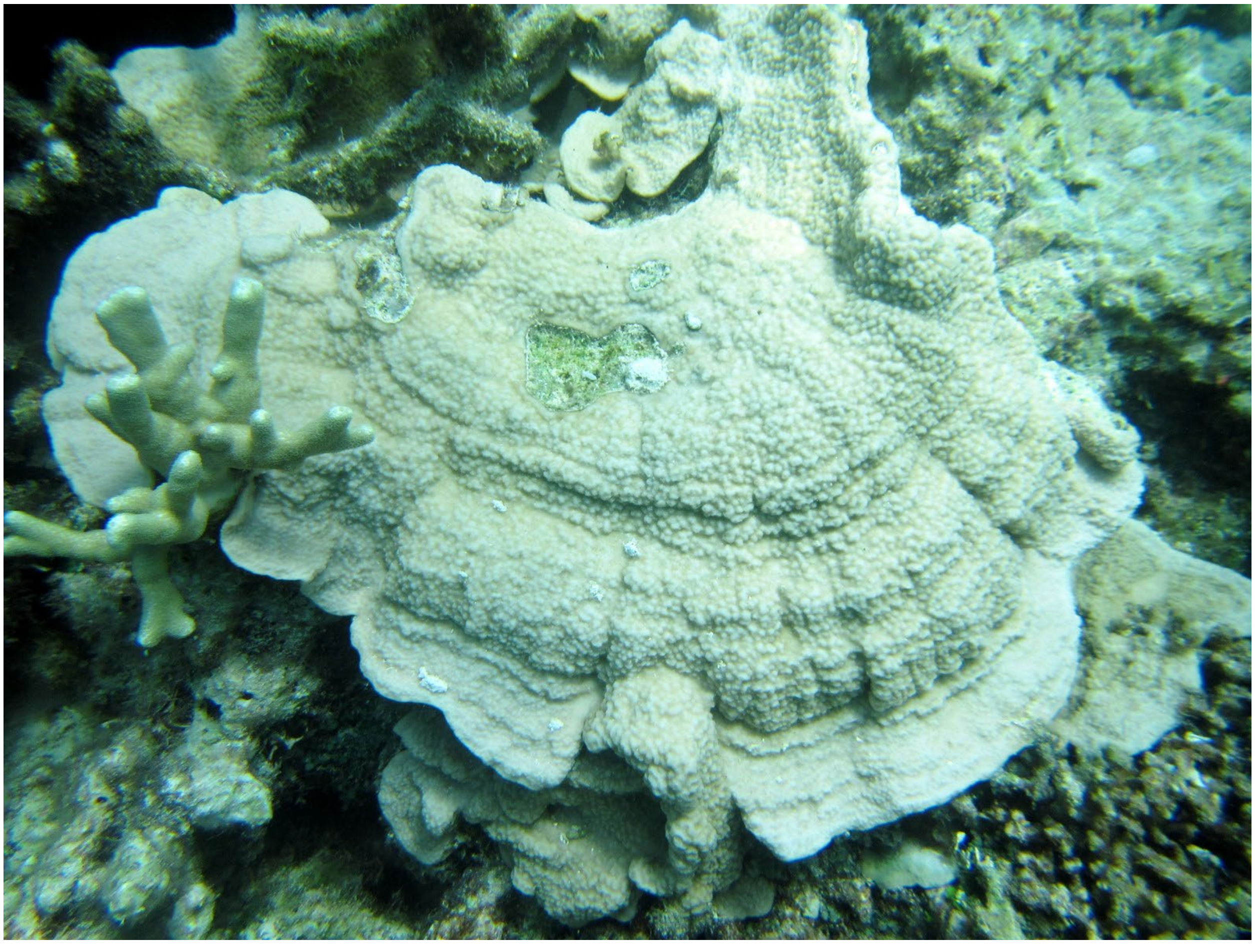
This species forms thin plates well off the bottom, which grow outward and upward at an angle. The upper surface is covered with tiny bumps that are often in rows. *Montipora hispida* has thin columns as well as plates, the plates are more horizontal, there are no radiating ridges on the plates, and colonies are brown.

A cluster of colonies of *Montipora* cf. *hodgsoni*.

A close-up photo of a colony of *Montipora* cf. *hodgsoni*. The upper surface is covered with tiny spines, which in some places are in radiating rows.

Montipora sp. 1

This species forms colonies with downward sloping plates that have many small bumps and concentric rings. The colony was over a foot diameter. *Montipora turtlensis* is similar but does not have little bumps, it has large lumps that may form columns, and whch are on the highest point on the plate.

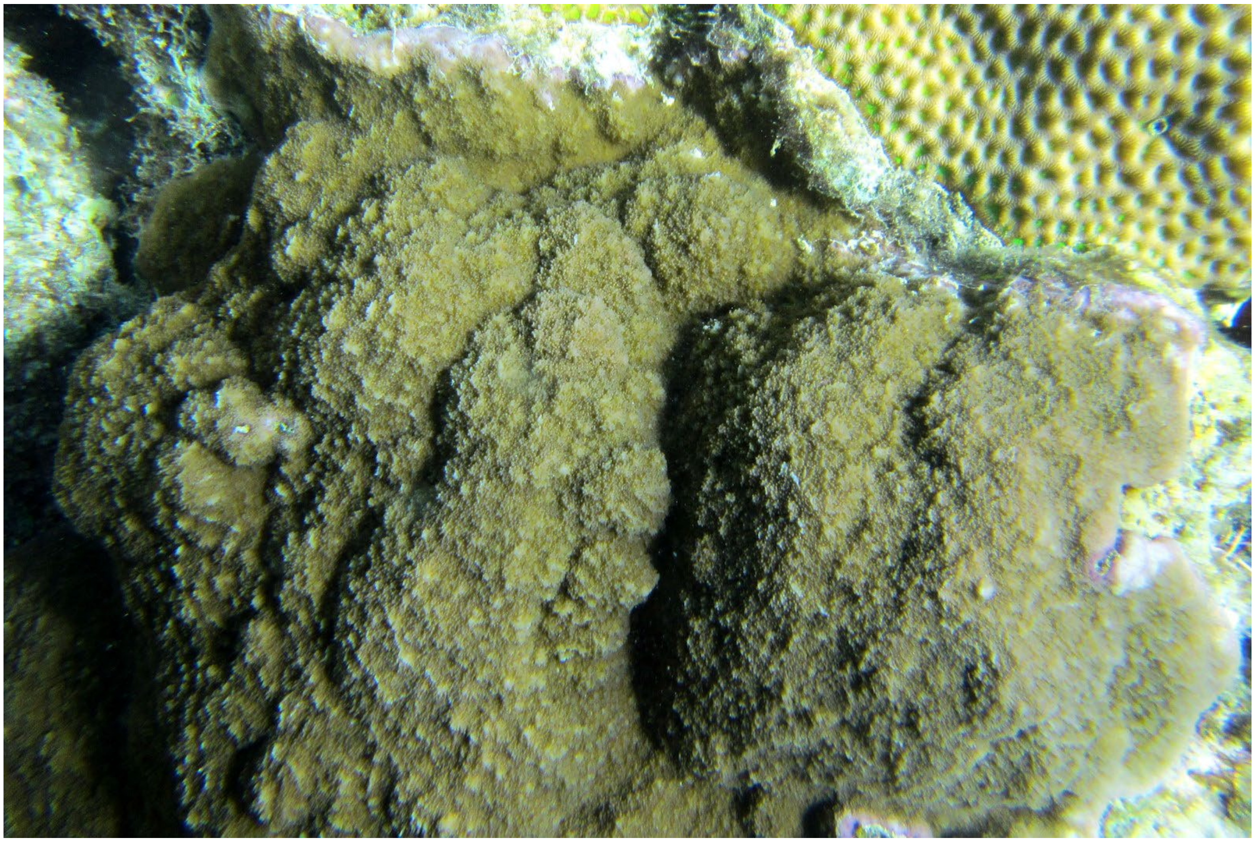


A photo of *Montipora* sp. 1.

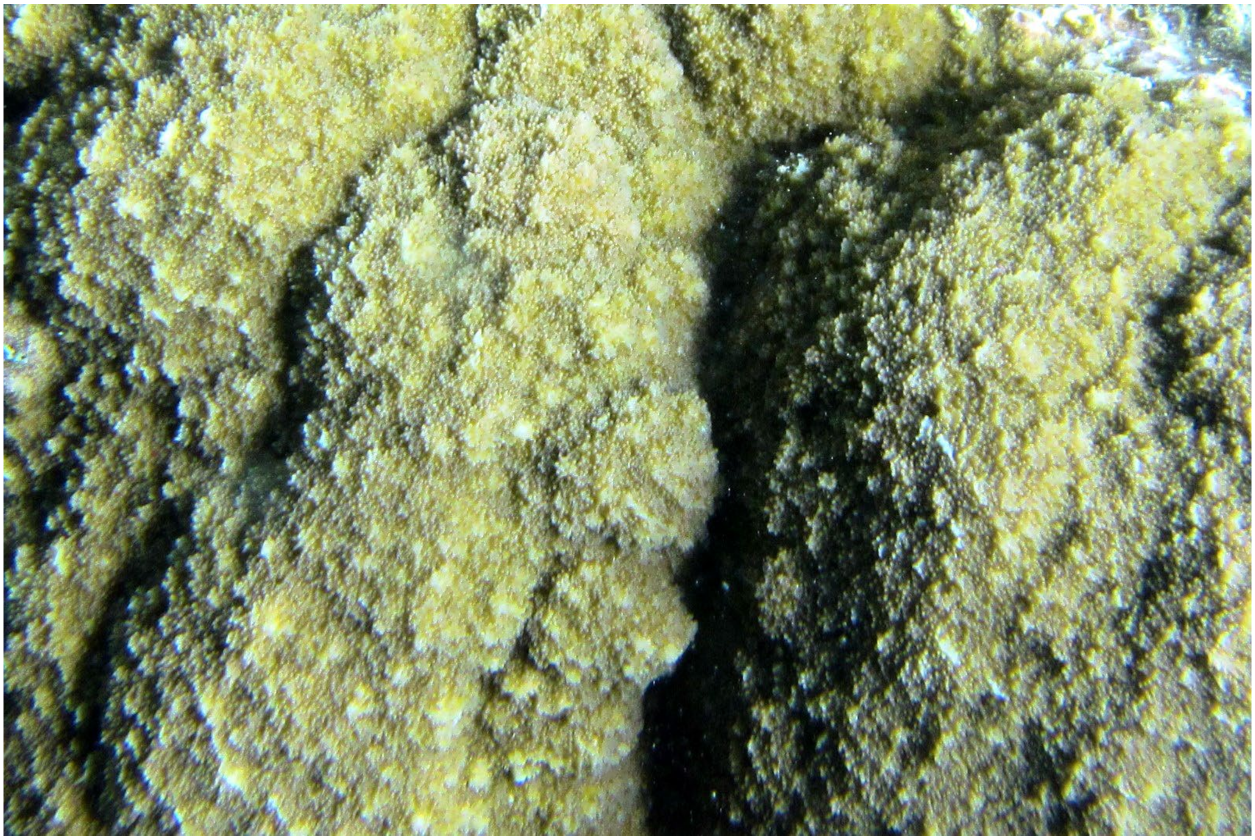
A close-up of the surface of *Montipora* sp. 1.

Montipora grisea

This species forms encrusting colonies covered with a forest of very tiny spines. The corallites may be raised in some places, surrounded by a ring of tiny spines. The spines are so tiny that the coral looks like sandpaper. *Montipora informis* has slightly larger spines which are uniform and usually have white tips.



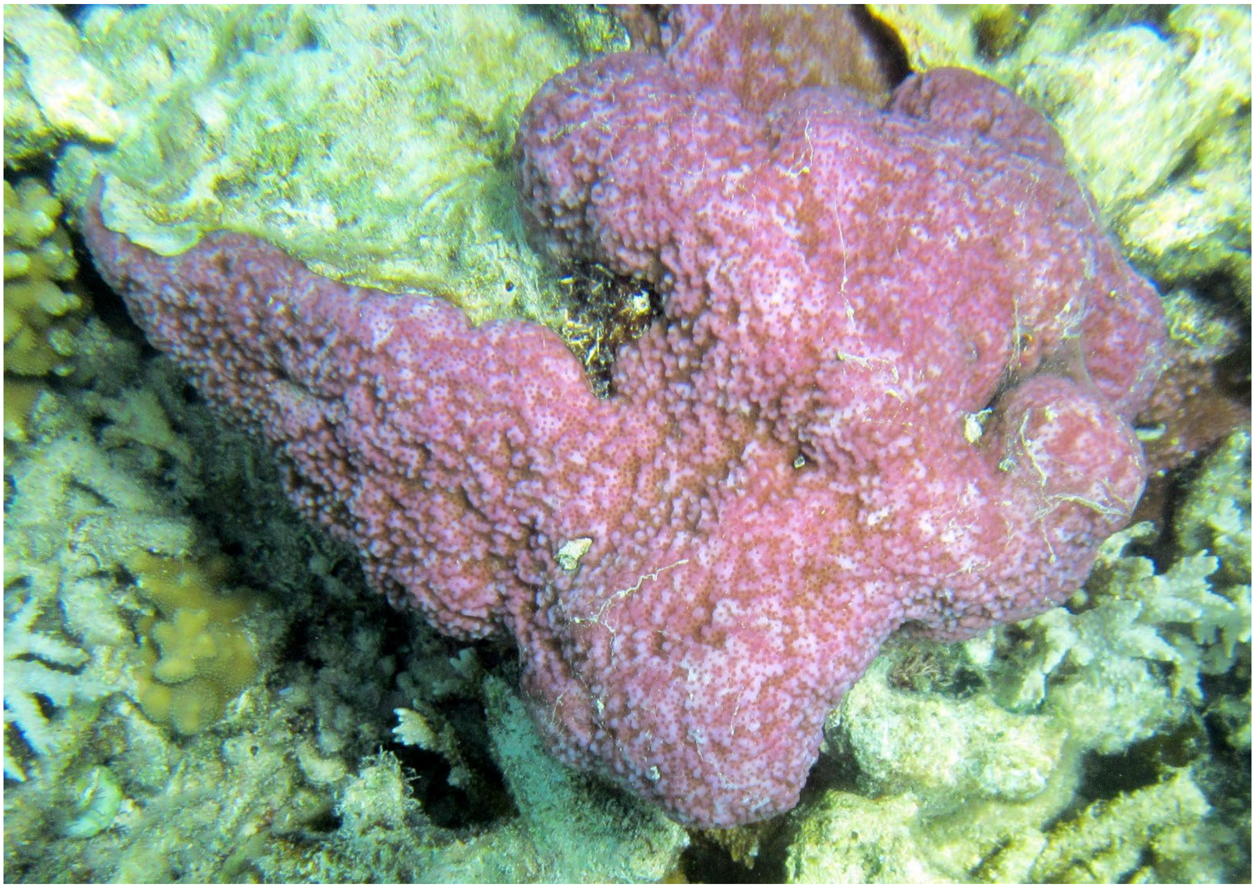
A colony of *Montipora grisea*.



A close-up photo of the surface of *Montipora grisea*, showing the tiny spines.

Montipora cf. floweri

This species forms encrusting or massive colonies with small bumps on the surface. There are no spines. Corallites are both between and on bumps. *Montipora hoffmeisteri* has larger bumps.



A colony of *Montipora* cf. *floweri*.

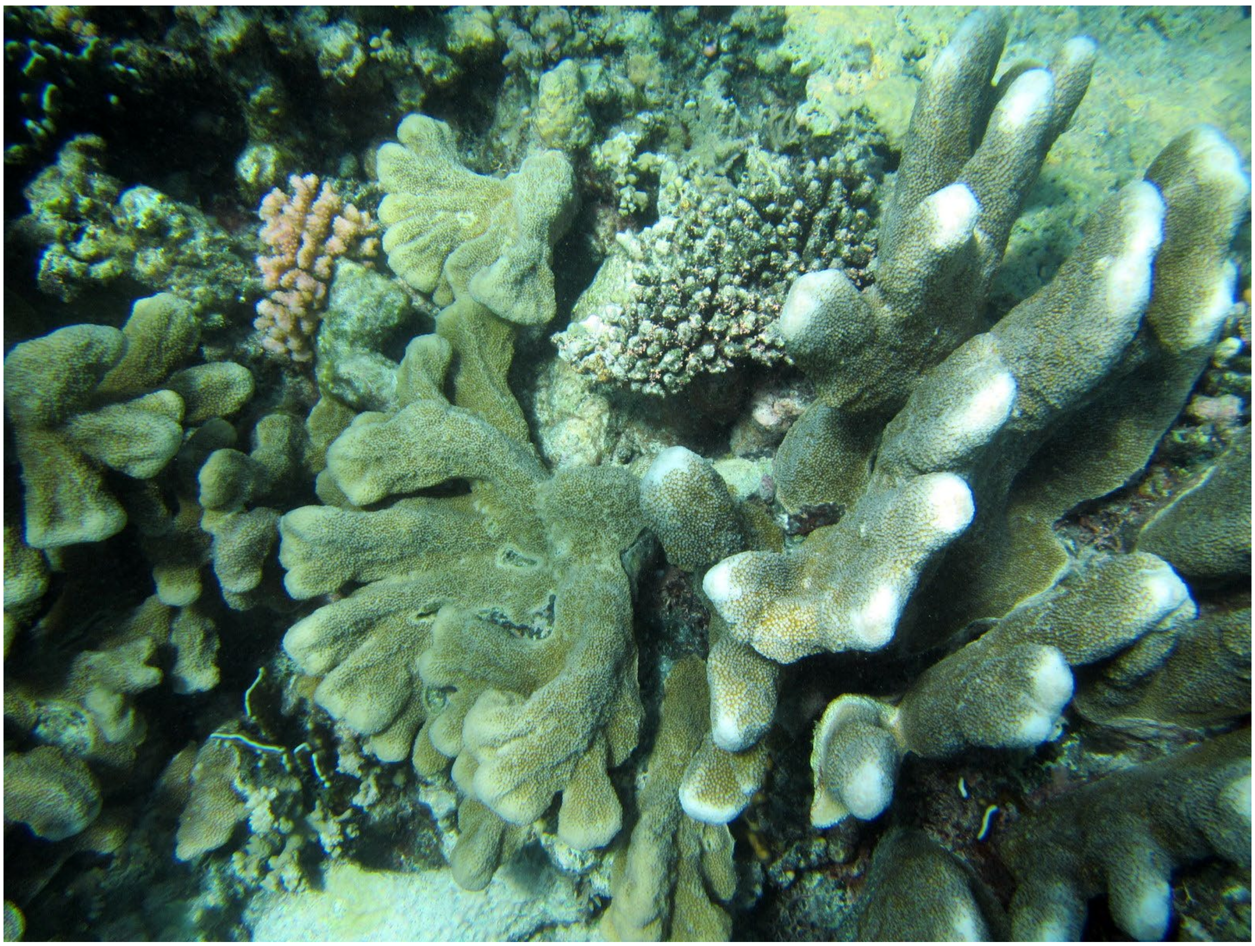
A magnified view of *Montipora* cf. *floweri*, showing the bumps and corallites.

Isopora

This genus forms colonies that are wall-shaped, branching, encrusting, plate edges, or a combination of these. The corallites are small and usually project as rounded tubes. Branches are usually thick, and always have more than one corallite on the end of the branch, usually many. *Acropora* has exactly one corallite on the end of each branch.

Isopora palifera

This species forms colonies with relatively smooth rounded or oval cross-section branches that are often about the diameter of a wrist. Branch ends are rounded and have many corallites on them. It does not form walls, the branches are smoother, and it has slightly larger corallites than *Isopora cuneata*, but these two are quite difficult to tell apart unless they are next to each other.

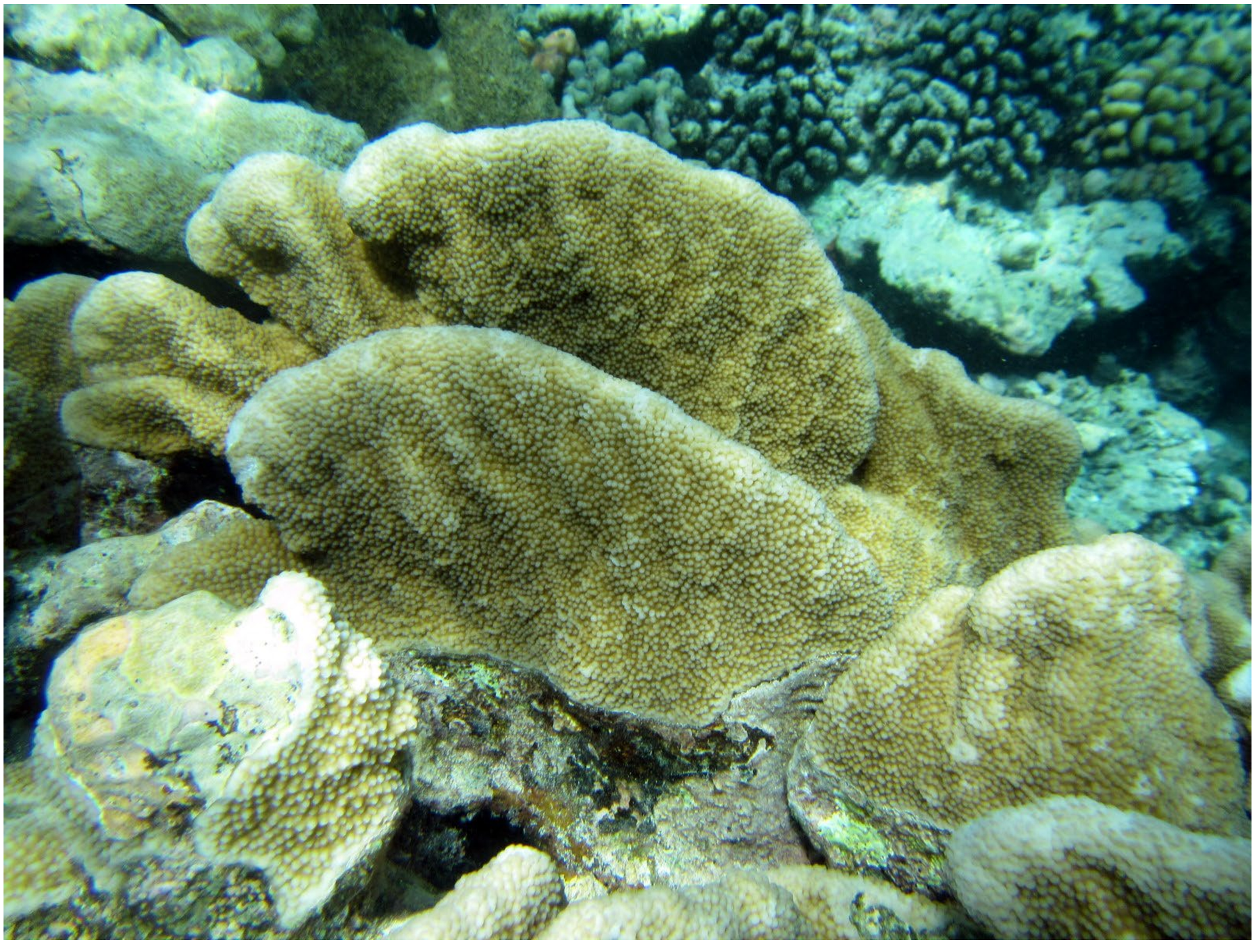


Isopora palifera colonies with vertical branches on the right and horizontal on the left. The branches on the left are not as smooth as on the right, so they might be *Isopora cuneata*.

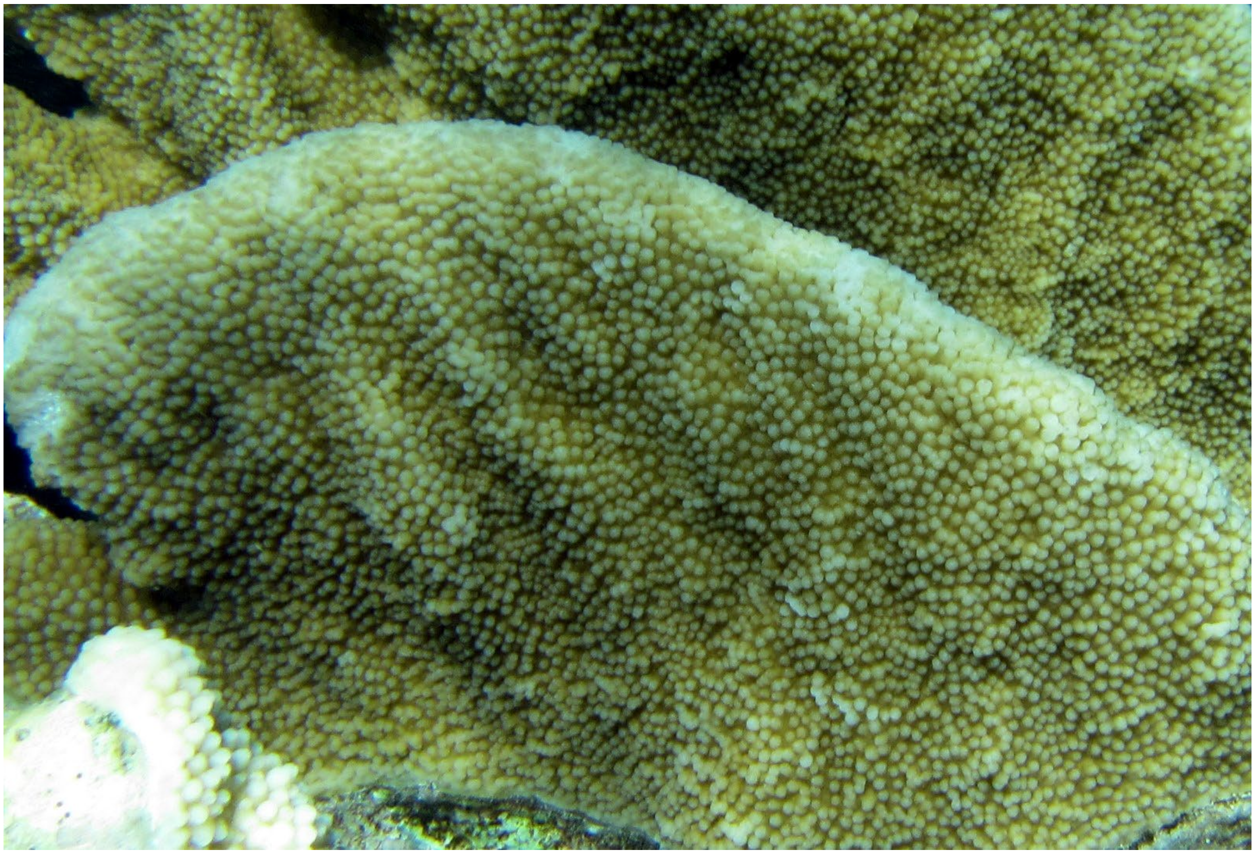
A close-up photo of *Isopora palifera*, showing the corallites and showing many corallites on branch ends.

Isopora cuneata

This species forms wall-like structures and/or thick branches with rounded ends and some ridges on the sides of branches. There are many corallites on the ends of branches and on the edges of plates. The corallites are slightly smaller than on *Isopora palifera*, but this is hard to see unless the two are side by side. *Isopora palifera* does not form wall-like colonies.



Colonies of *Isopora cuneata*.



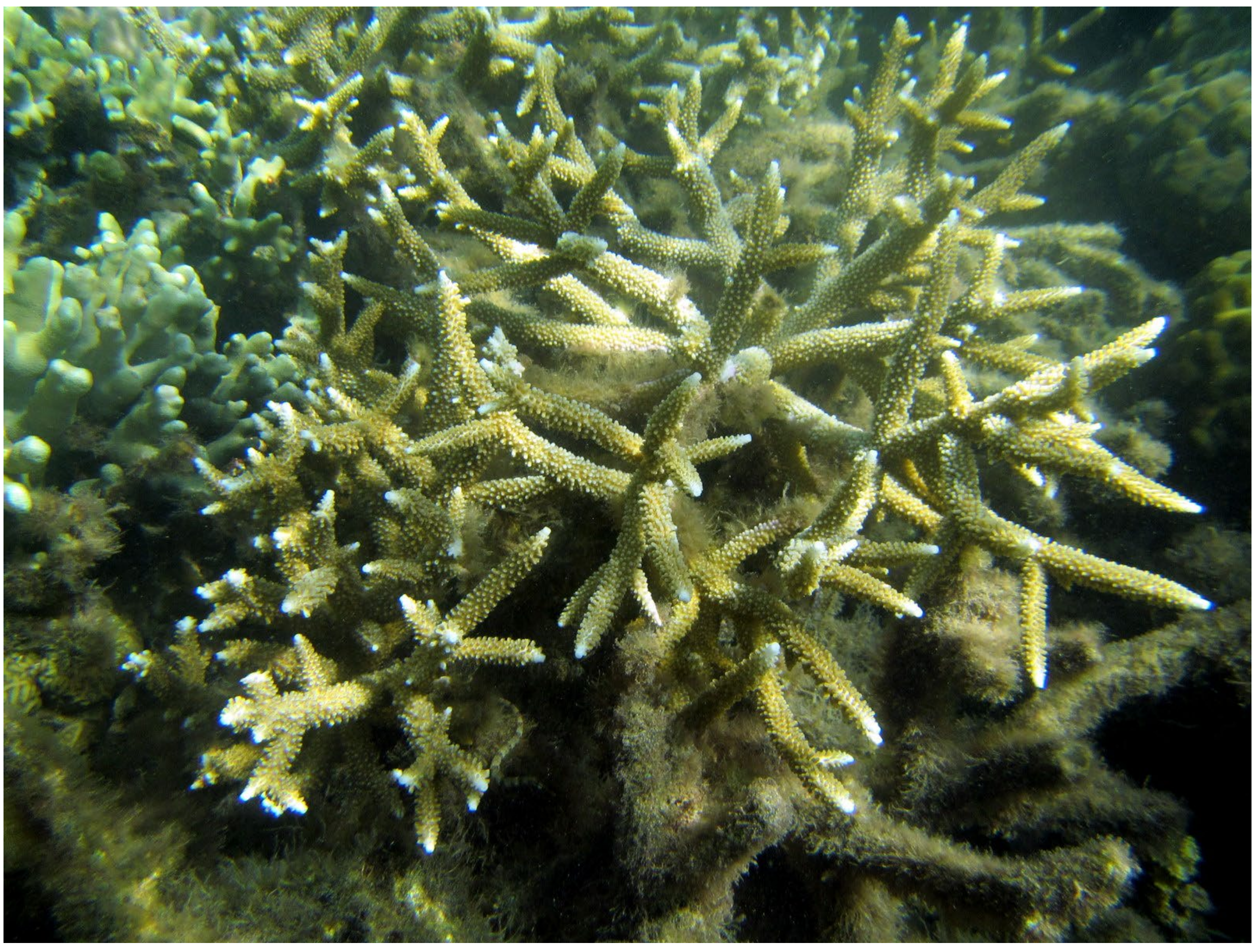
A close-up photo of *Isopora cuneata*.

Acropora

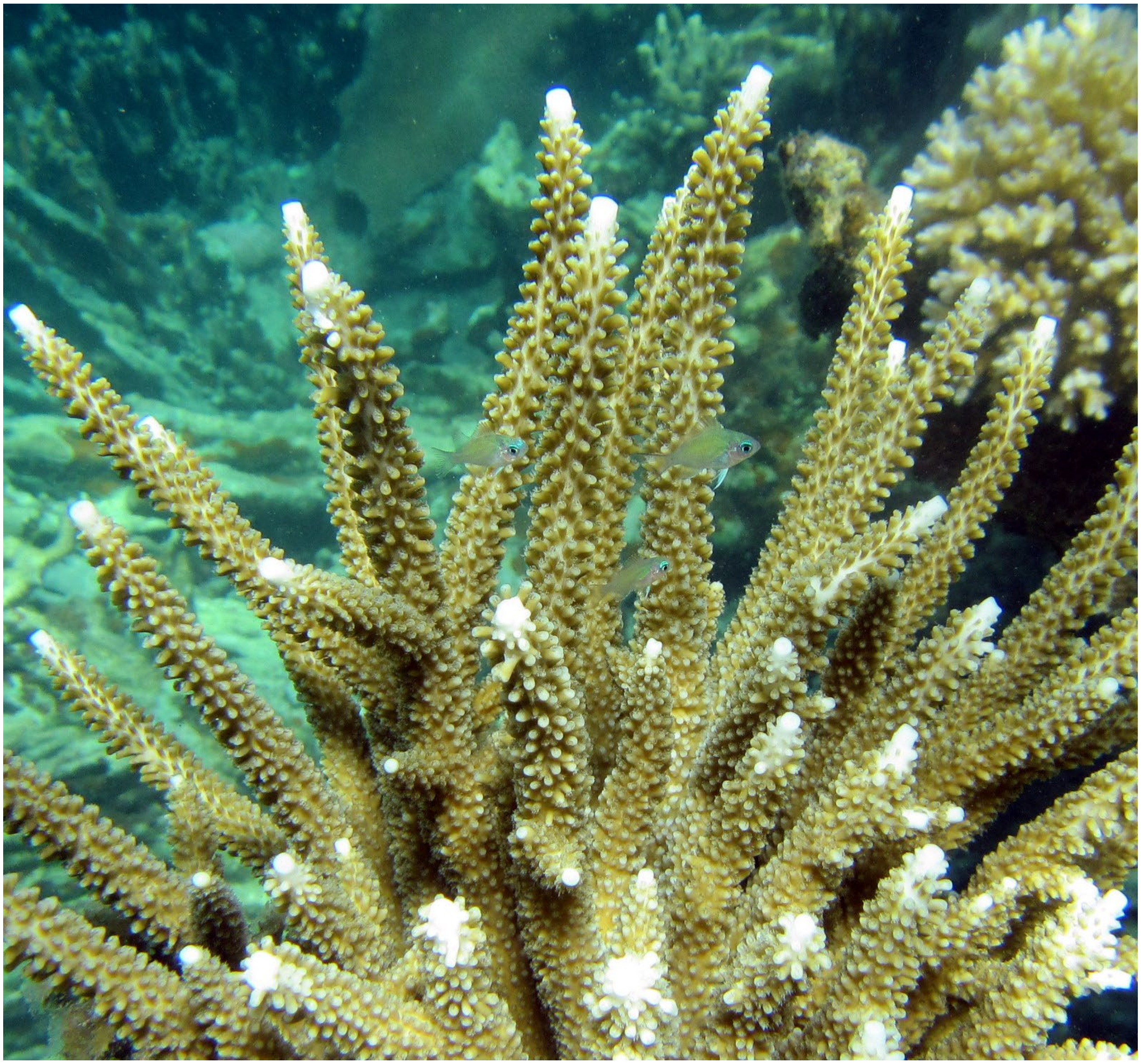
Acropora is the largest genus of corals, with over 165 species around the world. They are also some of the most abundant and thus are major reef builders. *Acropora* are always branching. The corallites and polyps that live in them are tiny, about 1 mm inside diameter. There is just one corallite and polyp on the end of each branch, but many on the sides of branches. The corallite on the end of a branch is often different from those on the sides of branches, and those on the sides of branches may have more than one shape. Colony shapes and the shapes of the corallites on branch sides are the two most helpful things for identifying species of *Acropora*. *Isopora* has several to many corrallites on the ends of branches, which are thick right to the end.

Acropora muricata "staghorn"

This species forms cylindrical branches that look a bit like deer antlers. Branches taper very gradually to relatively sharp tips. Colonies can be small or form large thickets of indefinite size. The bases of branches are thinner than on *Acropora intermedia* and corallites are more uniform, longer and thinner than on *Acropora intermedia*.



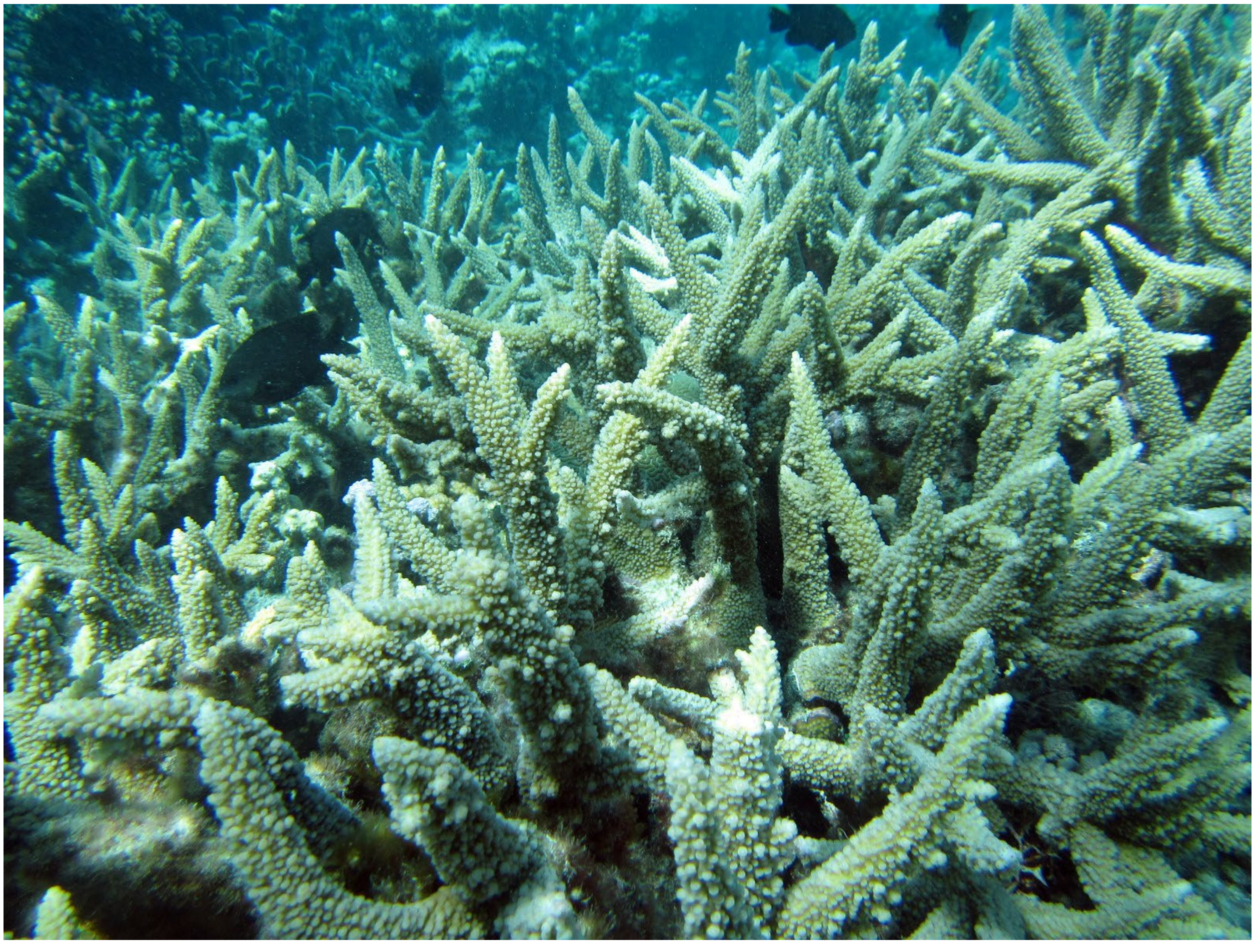
A colony of *Acropora muricata*.



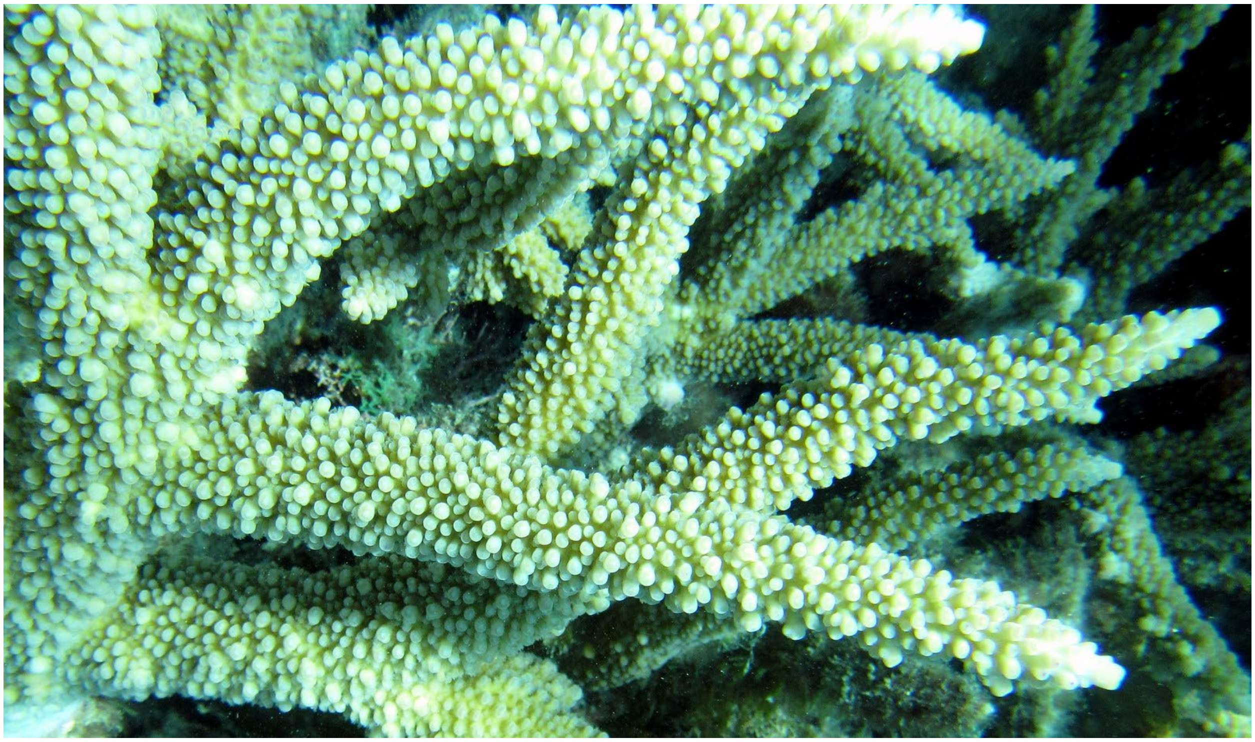
A close-up of *Acropora muricata*.

Acropora intermedia "staghorn"

This species forms staghorn colonies with cylindrical branches that taper along their length to a relatively sharp tip. The basal branches of this species are usually a bit larger than on other staghorns. The radial corallites on branch sides are variable in size, short, thick-walled, and their opening is cut at a slant so the polyp points toward the branch tip. *Acropora muricata* and *Acropora pulchra* have thinner basal branches. *Acropora muricata* has longer, thinner radial corallites that are one size. *Acropora pulchra* often has tentacles extended, and has radial corallitess that have extended lower lips.



A photo of a field of *Acropora intermedia* showing the staghorn branch shape.



A close-up photo of *Acropora intermedia* showing the axial and radial corallites.

Acropora pulchra "staghorn"

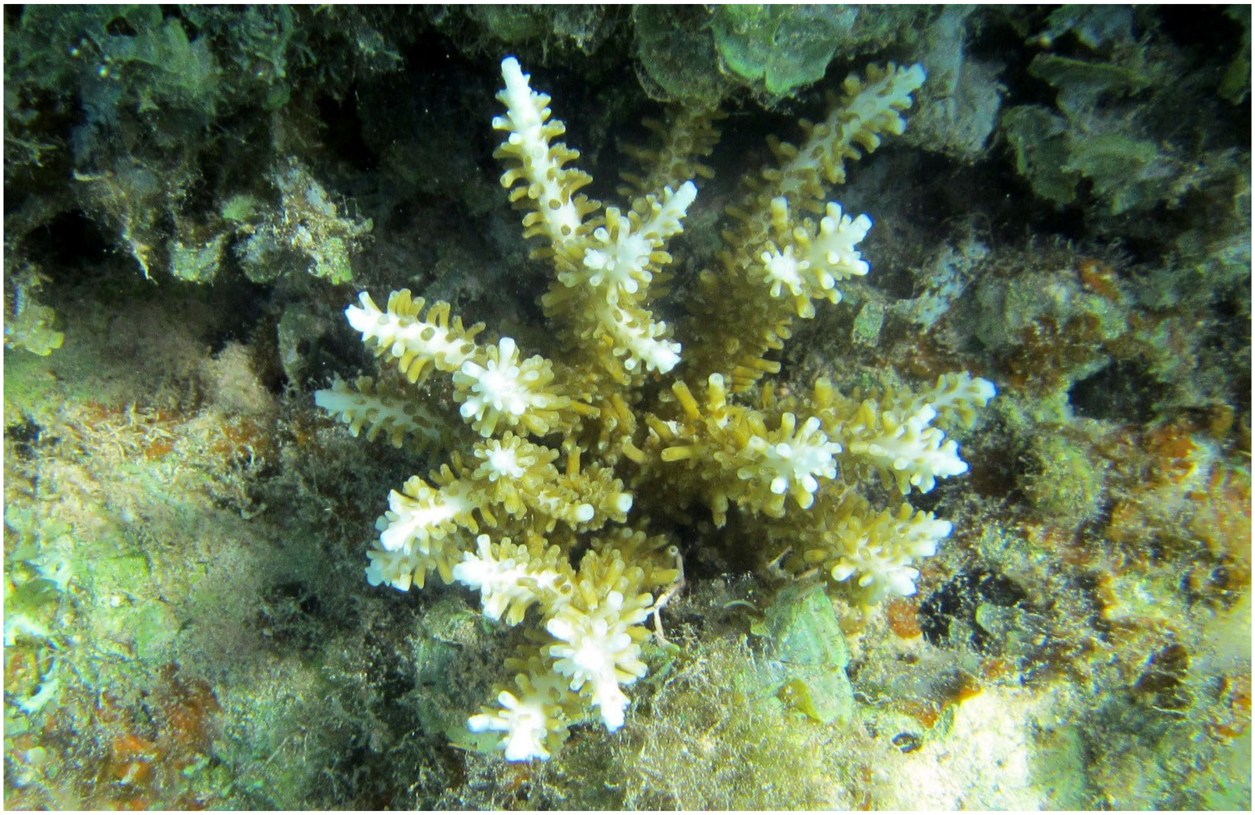
This species forms branching colonies that look like deer antlers and so are called "staghorns." The branches are cylindrical and about as thick as a finger. This species prefers calm or shallow water. Staghorns can make "thickets" of indefinite size. In this species, the axial corallite is a small tube, and the radial corallites are strongly inclined towards the branch tip, with the opening cut so strongly at an able that all that is left of the corallite is a lower lip. Usually there are two sizes of corallites, larger ones and smaller ones. Tentacles are usually extended and although they are small they usually cover up all but the larger corallites. *Acropora muricata* does not have tentacles extended and radial corallites are tubular and one size. *Acropora intermedia* has thicker basal branches.

An *Acropora pulchra* thicket.

A close-up of *Acropora pulchra*.

Acropora cf pectinata

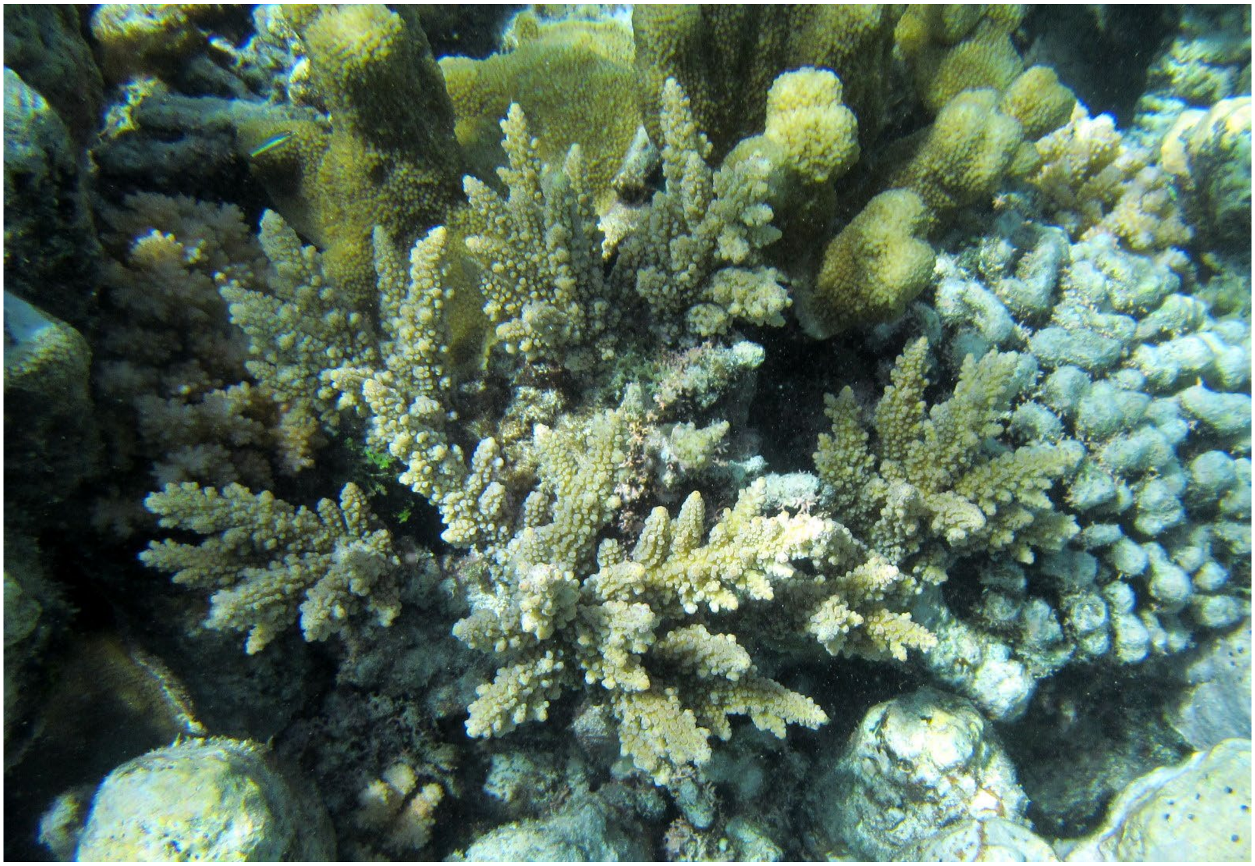
This species forms branching colonies with very long tube-shaped radial corallites that may be arranged in rows. Radial corallites are longer and farther apart than on *Acropora muricata*.



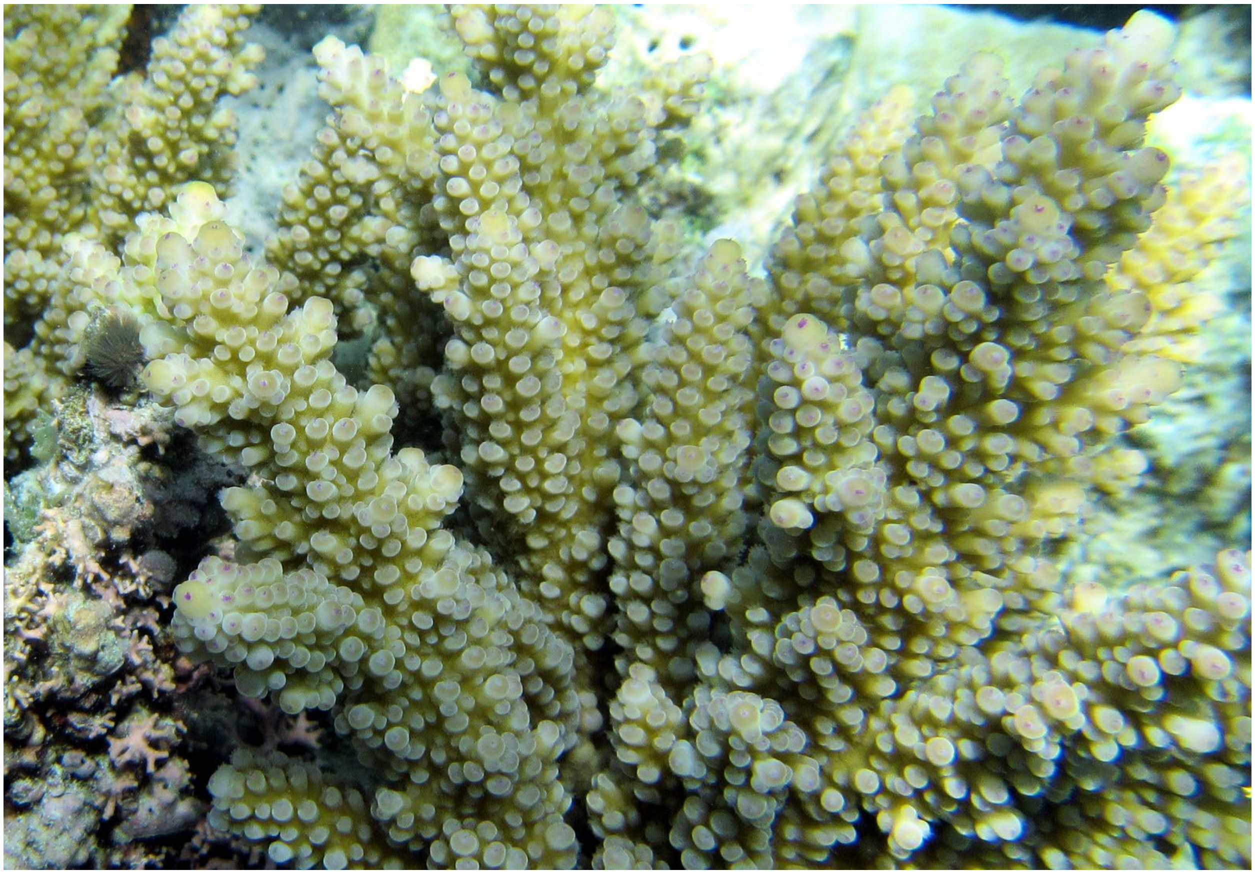
A close-up photo of *Acropora* cf. *pectinata*.

Acropora austera

This species forms branching colonies with many proliferating branches that may be partly fused together, forming an irregular shape colony that has sturdy branches but is clearly not a staghorn. The axial corallites are relatively thick tubes and the radial corallites are short, fat and have thick walls. Branches are more irregular and fused and short than on other staghorns. Corallites are shorter, tubular, and have thicker walls than other staghorns. Colonies are bushier than *Acropora verweyi*, which has shelf-like radial corallites.



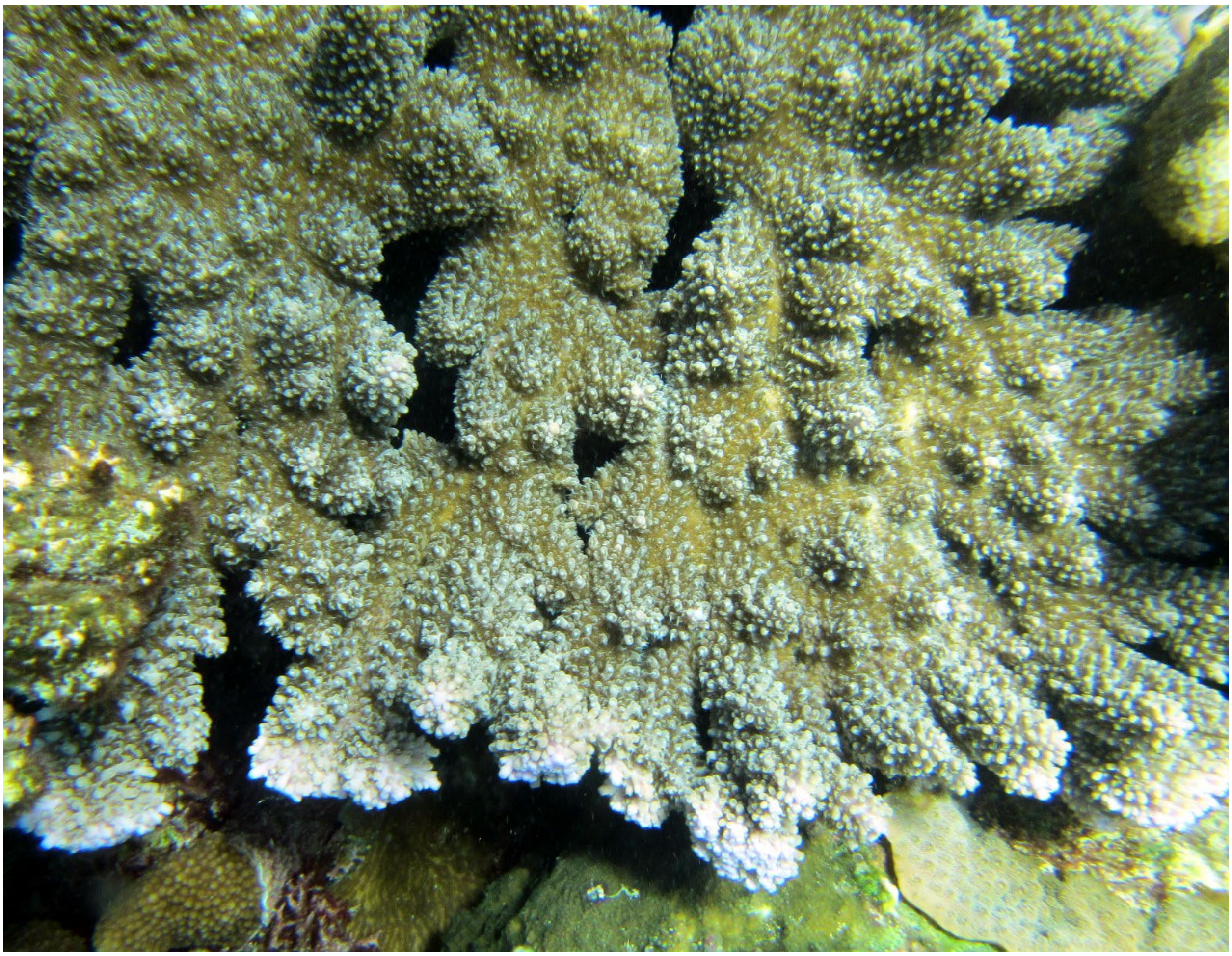
A colony of *Acropora austera*.



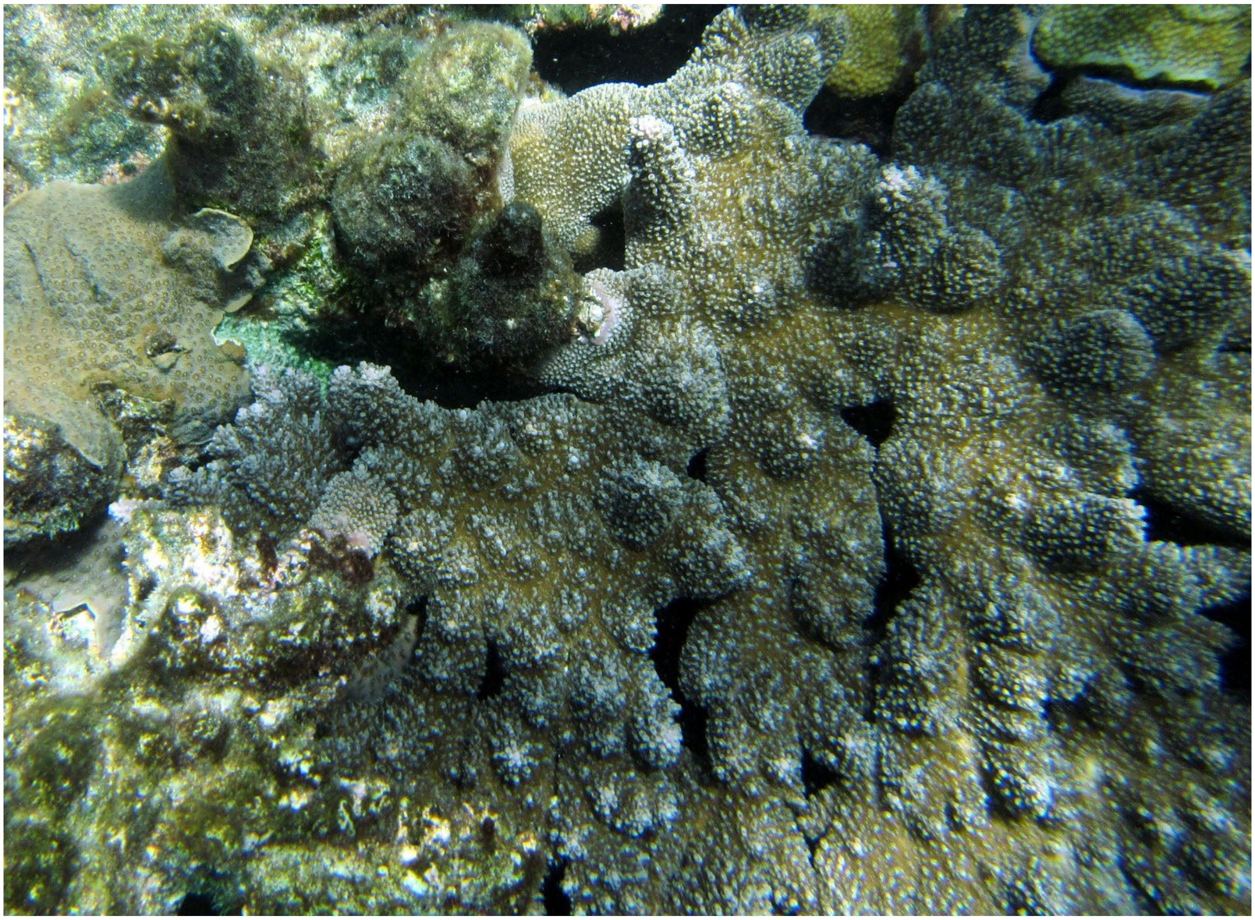
A close-up photo of *Acropora austera*, showing the large axial corallites which are often yellow with a purple dot in the center, and the short, fat, thick-walled radial corallites. There are many places where a radial is growing larger and starting a new branch, which we call an “incipient axial” corallite.

Acropora abrotanoides

This species forms discrete colonies which almost always include some nearly vertical but often somewhat irregular branches, and other branches that grow horizontally and often end in horizontal fans of partly fused short branches. In some colonies the horizontal branches can fuse together so well they can form a section of horizontal plate. Near the branch tips of horizontal branches the radial corallites are long tubes inclined towards the branch tip, but farther from the branch tip they are short and the opening is cut at an angle. Axial corallites are tubes. The only colony found alive was mostly fused plate, but shows stubby vertical branches and radiating fused branches along the edge. Colonies are discrete unlike staghorns and branches are more irregular. Branches are more irregular than on *Acropora robusta* and radial corallites near branch tips are tubular.



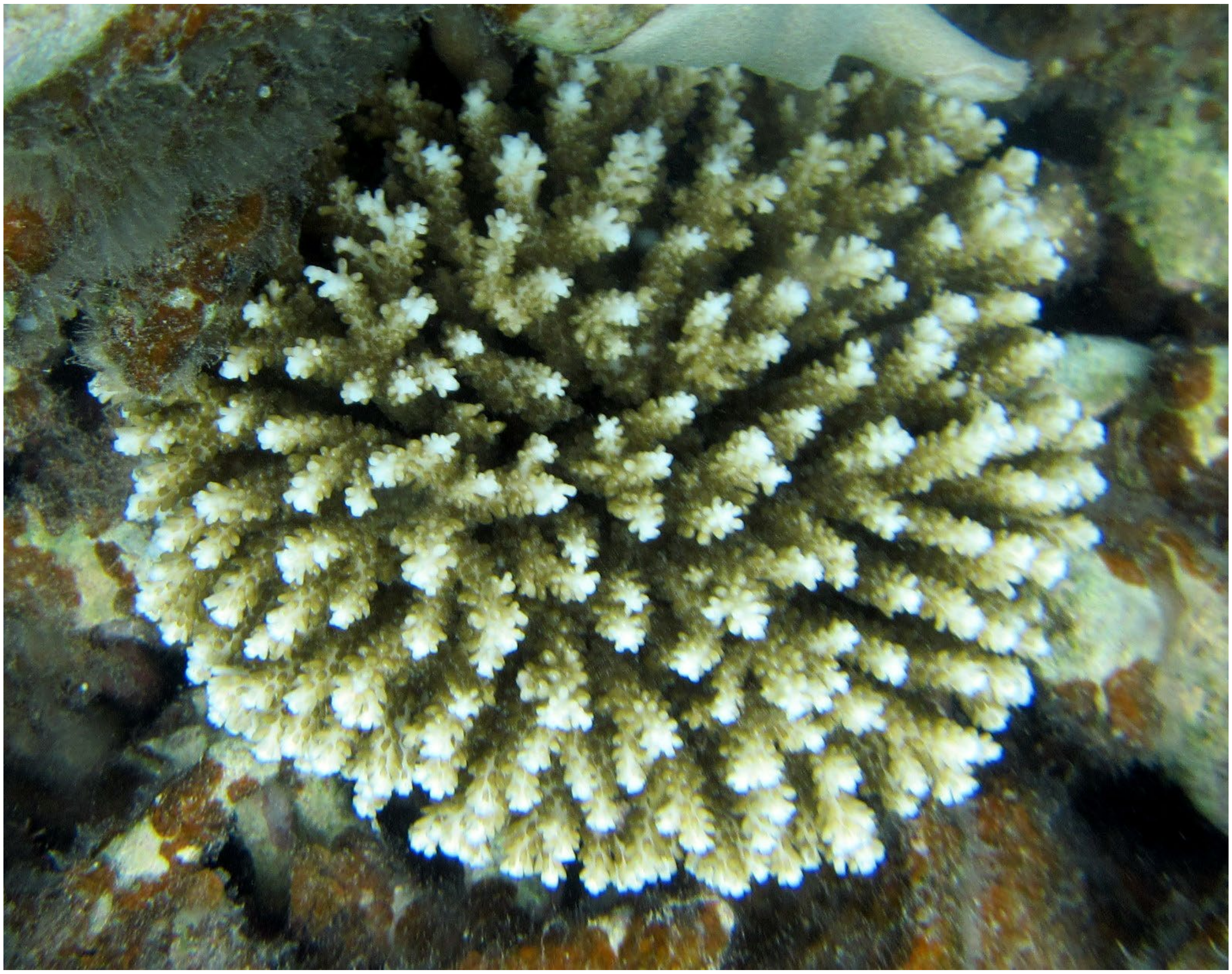
The edge of a plating colony, showing the fused branches. The radial corallites are often longer near the branch tips than on this colony.



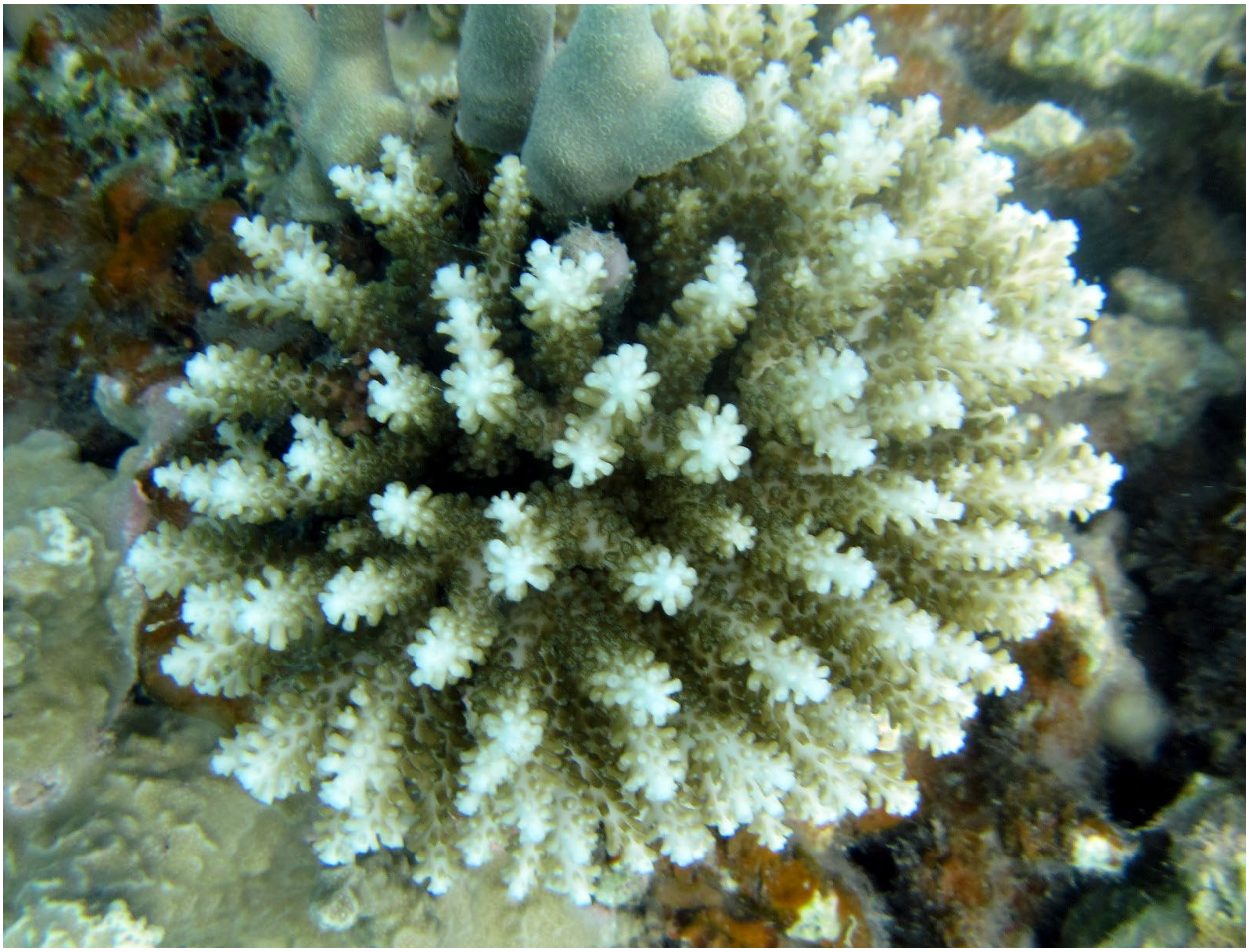
Another part of this small colony, showing some branches starting to grow upward. In a more mature colony, these branches will be 6 inches taller or more.

Acropora cf. insignis

This species forms small bushy colonies. The outer parts of branches are white, with brown radial corallites on them. Other species don't have brown radial corallites on white branches.



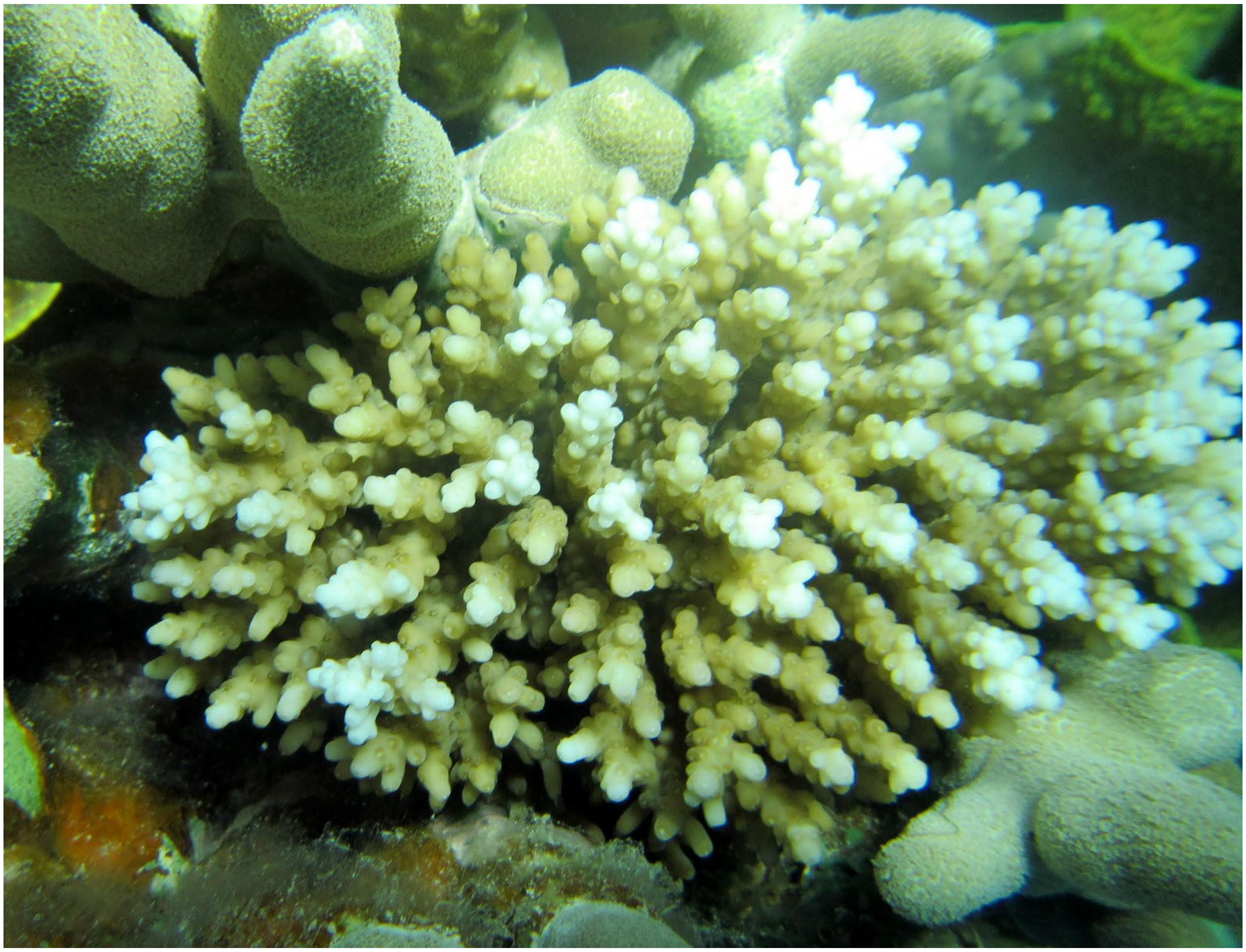
A colony of *Acropora* cf. *insignis*.



A close-up photo of *Acropora insignis*. The branches look spotted, with the dark spots being the brown corallites on the white branches.

Acropora aculeus Vulnerable

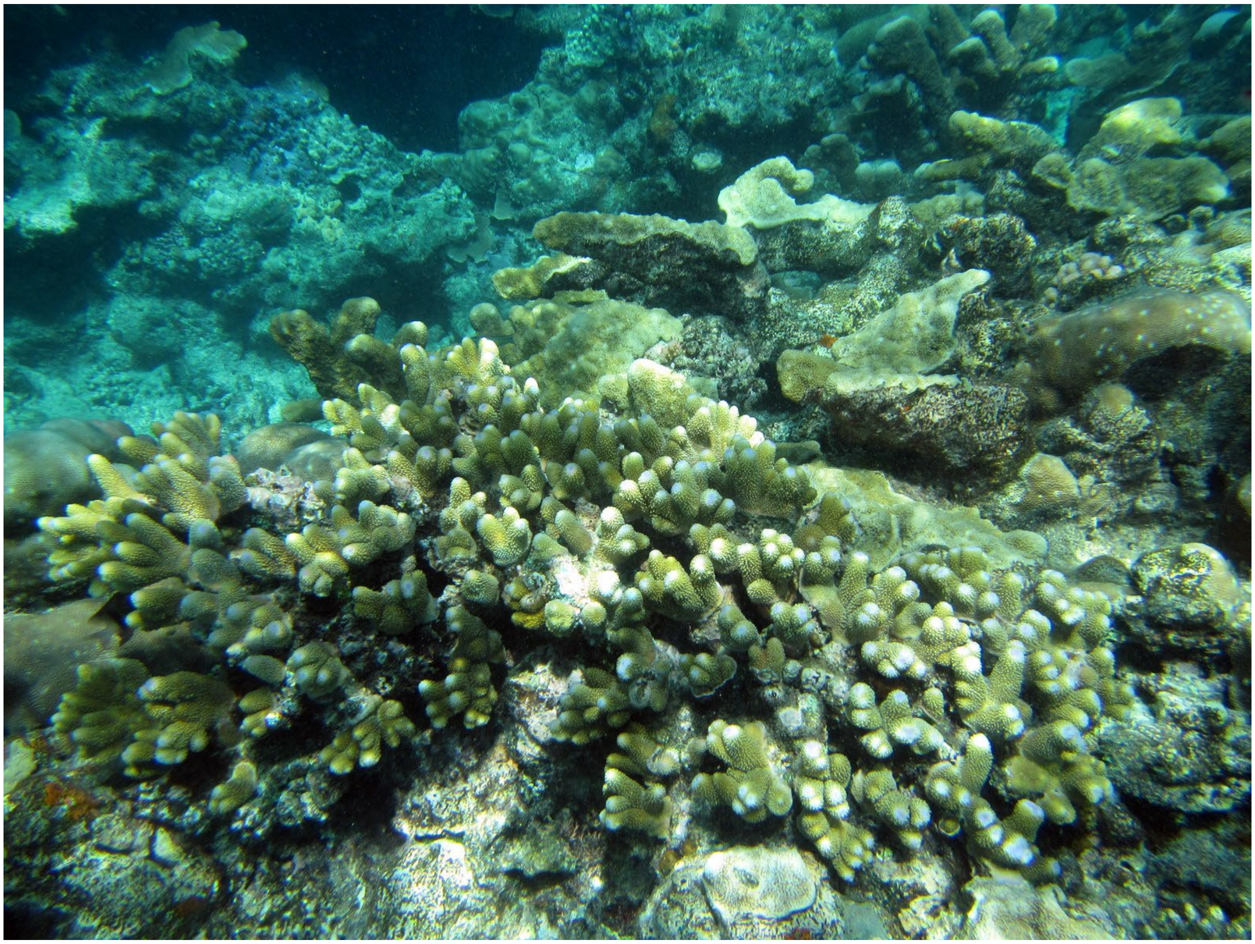
This species forms cushion-shaped colonies with small branches that have very short radial corallites. *Acropora granulosa* has many long tubular incipient axial corallites.



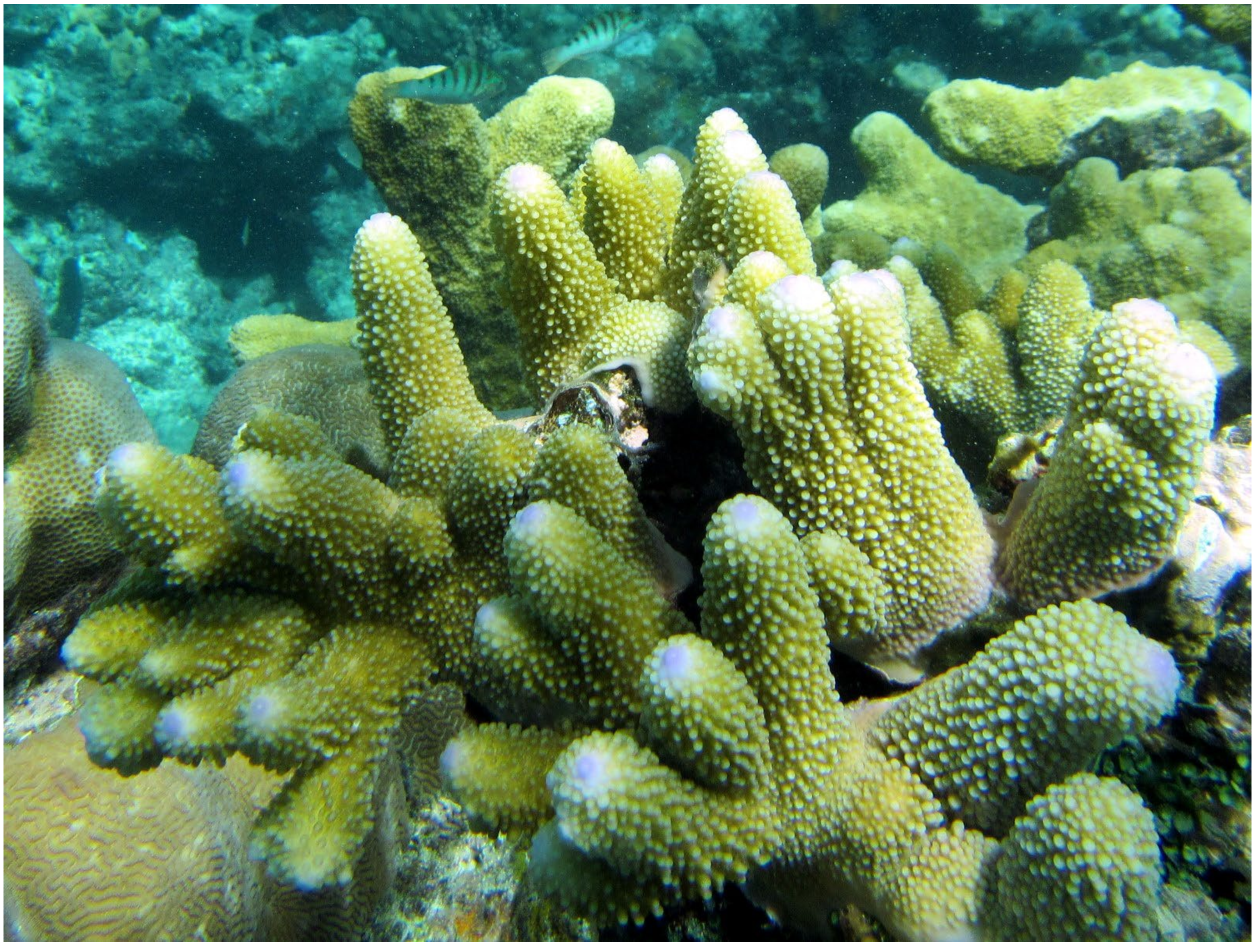
A close-up photo of a colony of *Acropora aculeus*.

Acropora monticulosa

This species forms colonies composed of many cylindrical, uniform, relatively short branches. They can make large mounds and may have dead areas between clusters of live branches. The branches look relatively smooth because the radial corallites are small and uniform. The axial corallite is also small. Usually colonies are a light brown and branches have blue tips. This species has longer branches than digitate species, and they can diverge and branch.



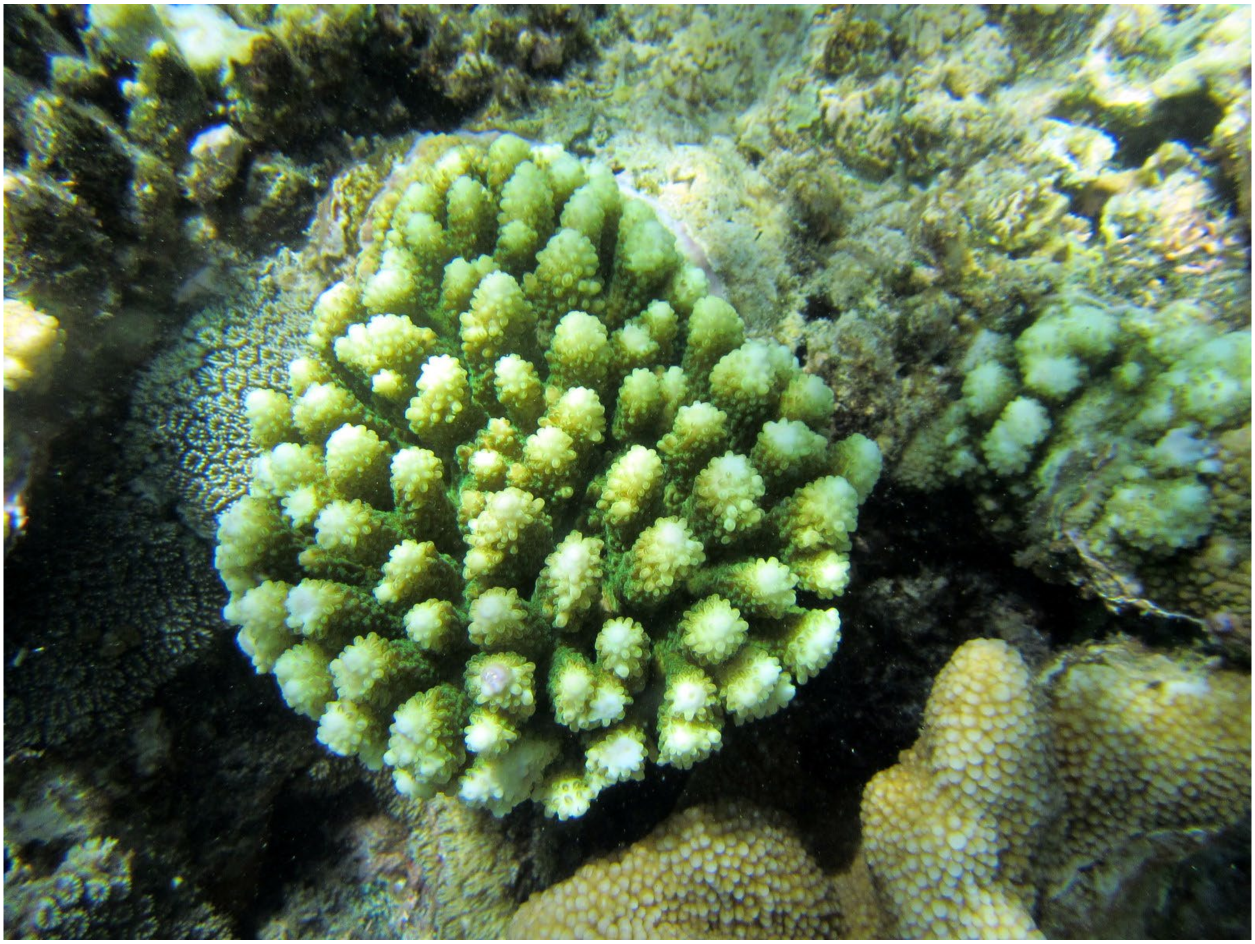
A colony of *Acropora monticulosa*.



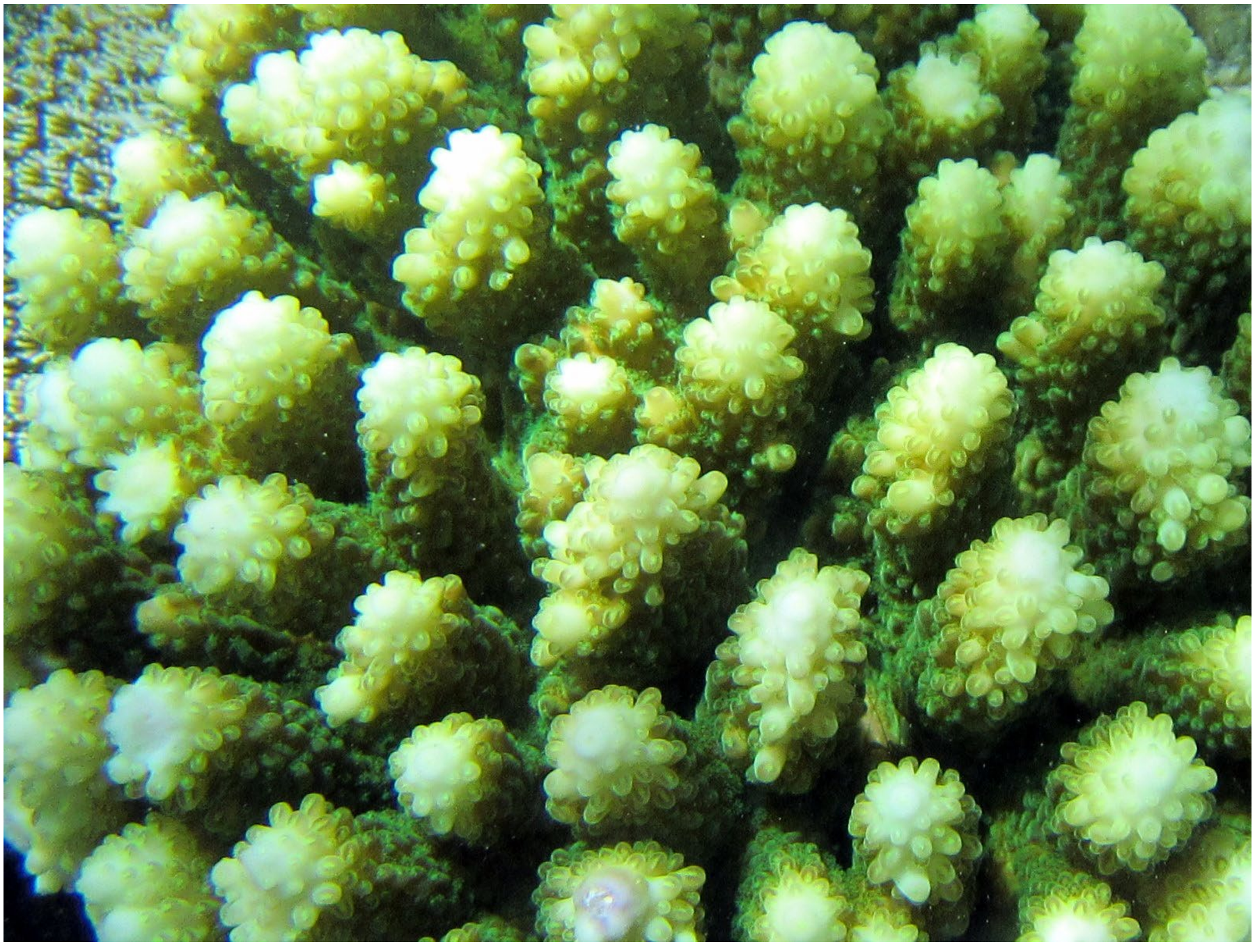
A close-up photo of *Acropora monticulosa* showing the uniform cylindrical branches, small corallites, and blue tips on the branches.

Acropora retusa Threatened Vulnerable

This species forms small colonies that have short, thick, vertical branches that are fairly uniform in height. When branches are finger-shaped like this, the colony is called “digitate”. The branches look spikey or prickly because the radial corallites vary in length. The radial corallites are thick walled tubes. The axial corallites are as large or larger than the radial corallites. The axial corallite projects farther than in most other species and often tapers slightly. Other digitate species have smoother branches.



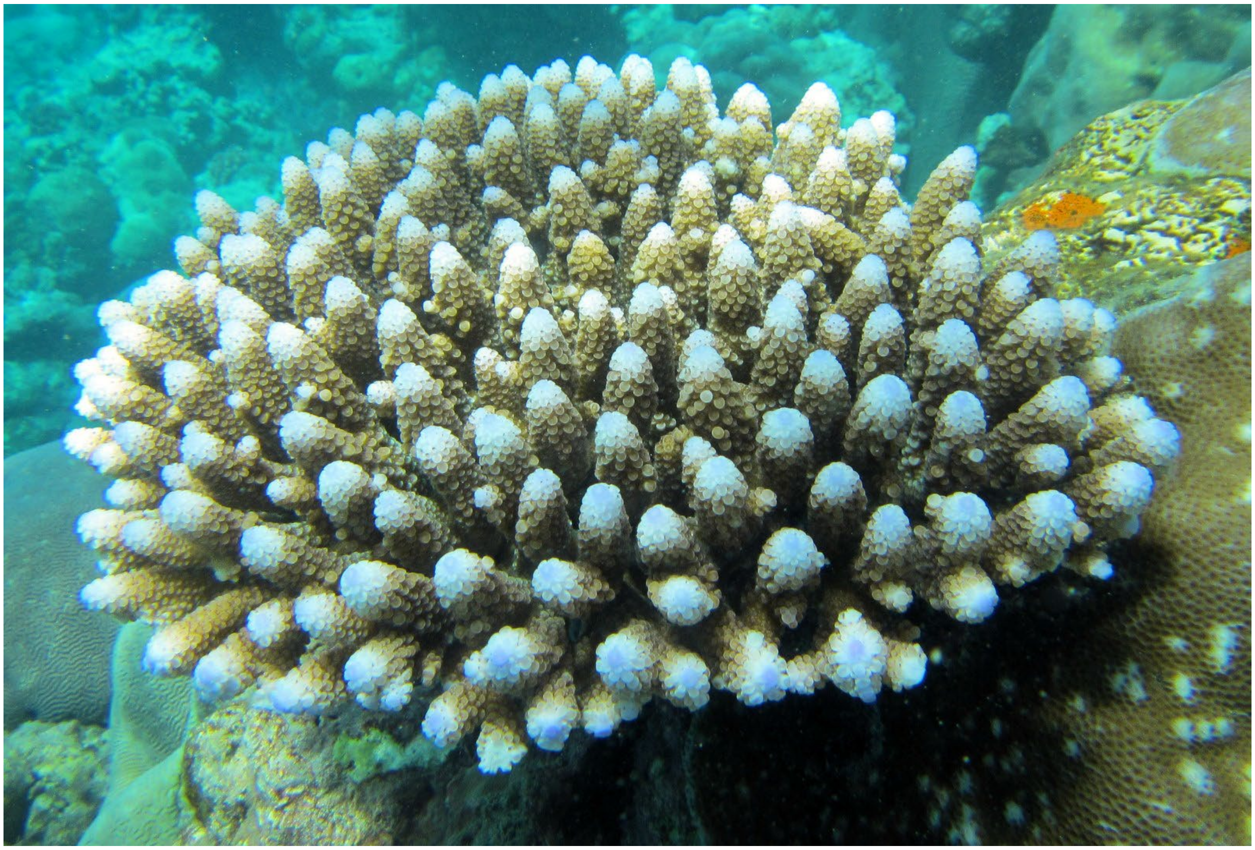
A colony of *Acropora retusa* showing the short, thick digitate branches that look bumpy or spikey.



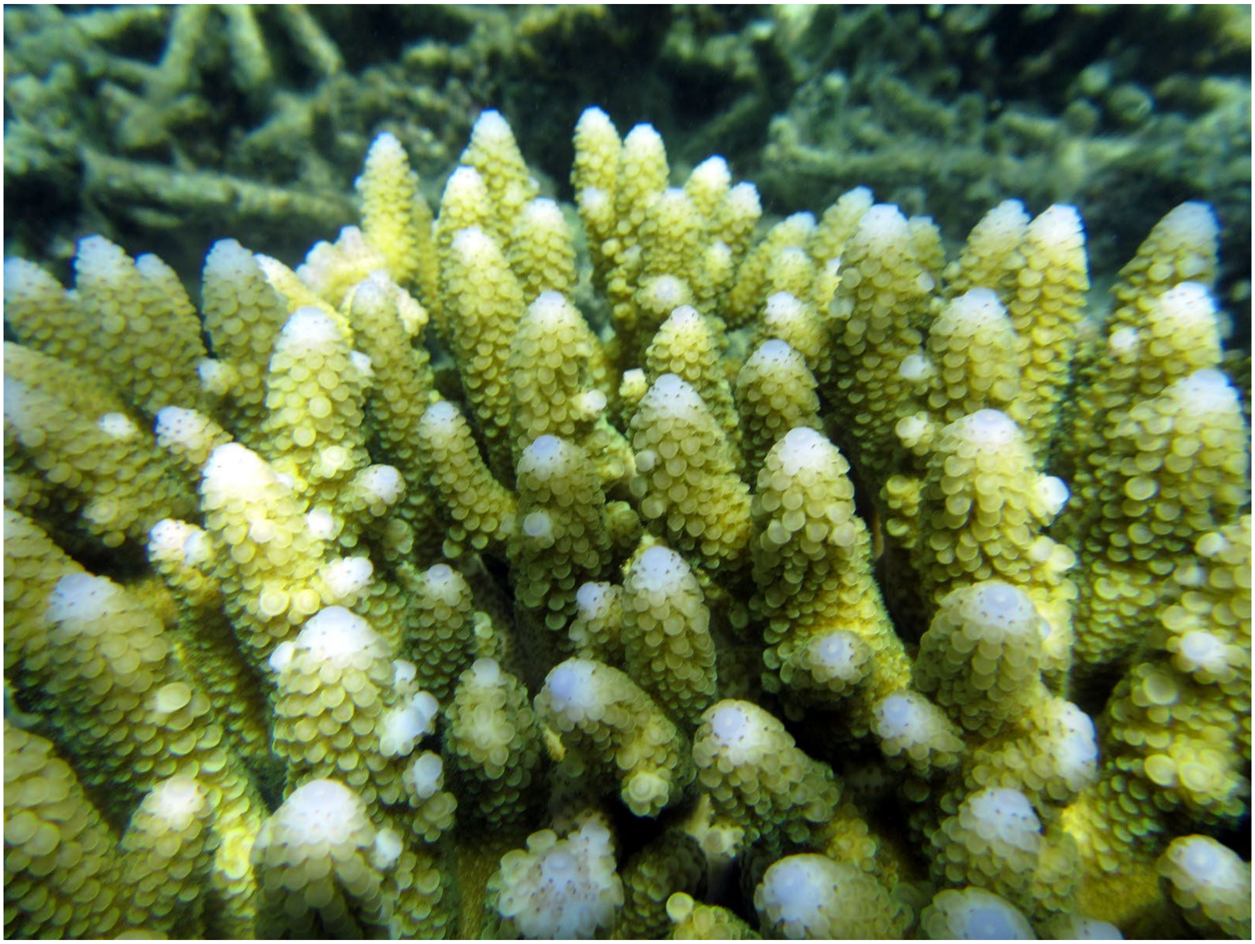
A close-up photo of branches on *Acropora retusa*. The radial corallites vary in length, some being quite long, and they have thick walls. Their openings point upwards. The axial corallite is relatively large.

Acropora digitifera

This species forms digitate colonies that are usually in shallow, often wave-swept locations. The branches have few if any sub-branches, are a uniform height, and are about the diameter of a small finger. The radial corallites are uniform and consist mainly of a lower wall that is somewhat gutter-shaped. The branch tips are often, but not always, blue. The branches are thinner and smoother than on *Acropora retusa*, and they have blue tips. The branches are thicker and the radial corallites less leafy than on *Acropora tenuis*.



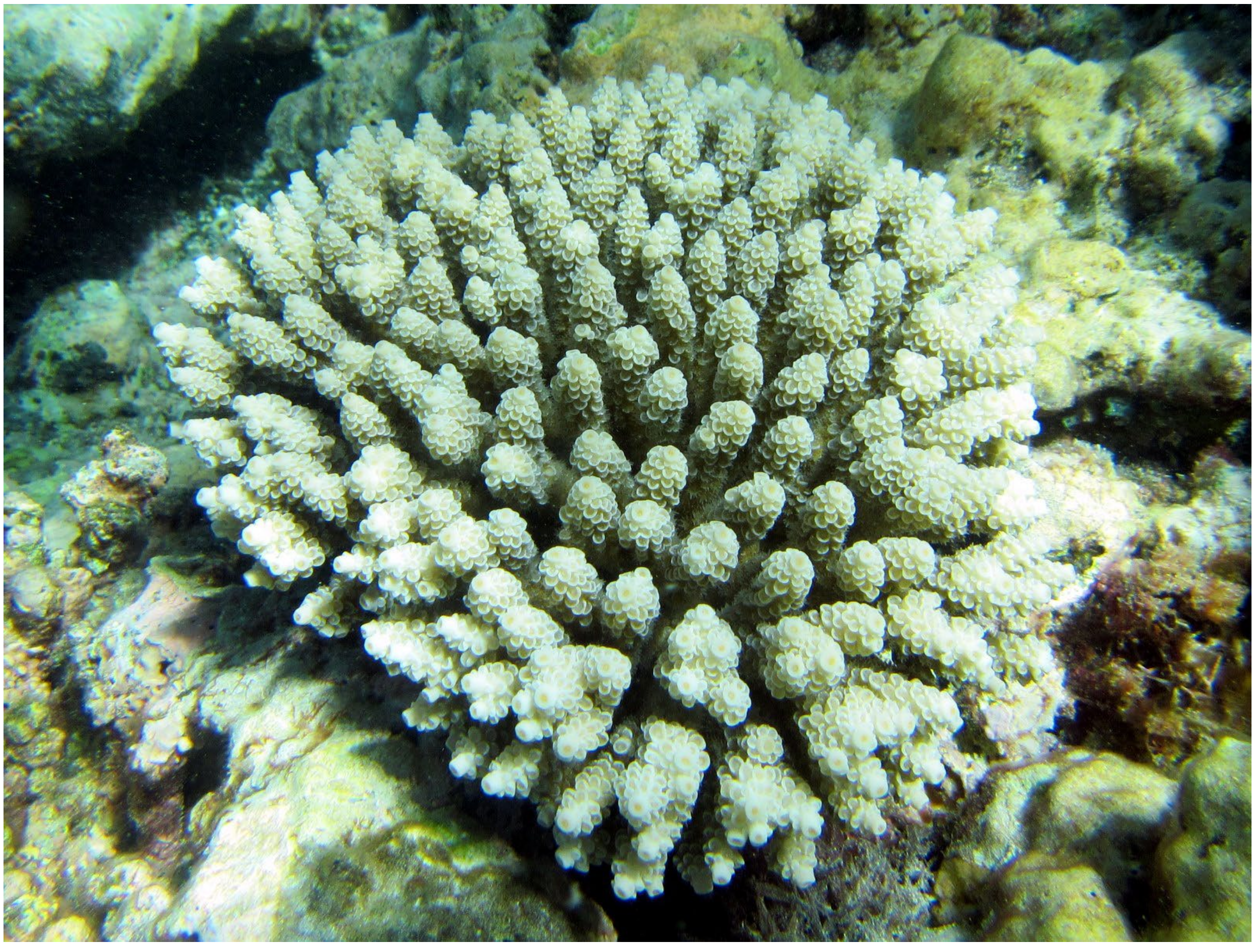
A colony of *Acropora digitifera*.



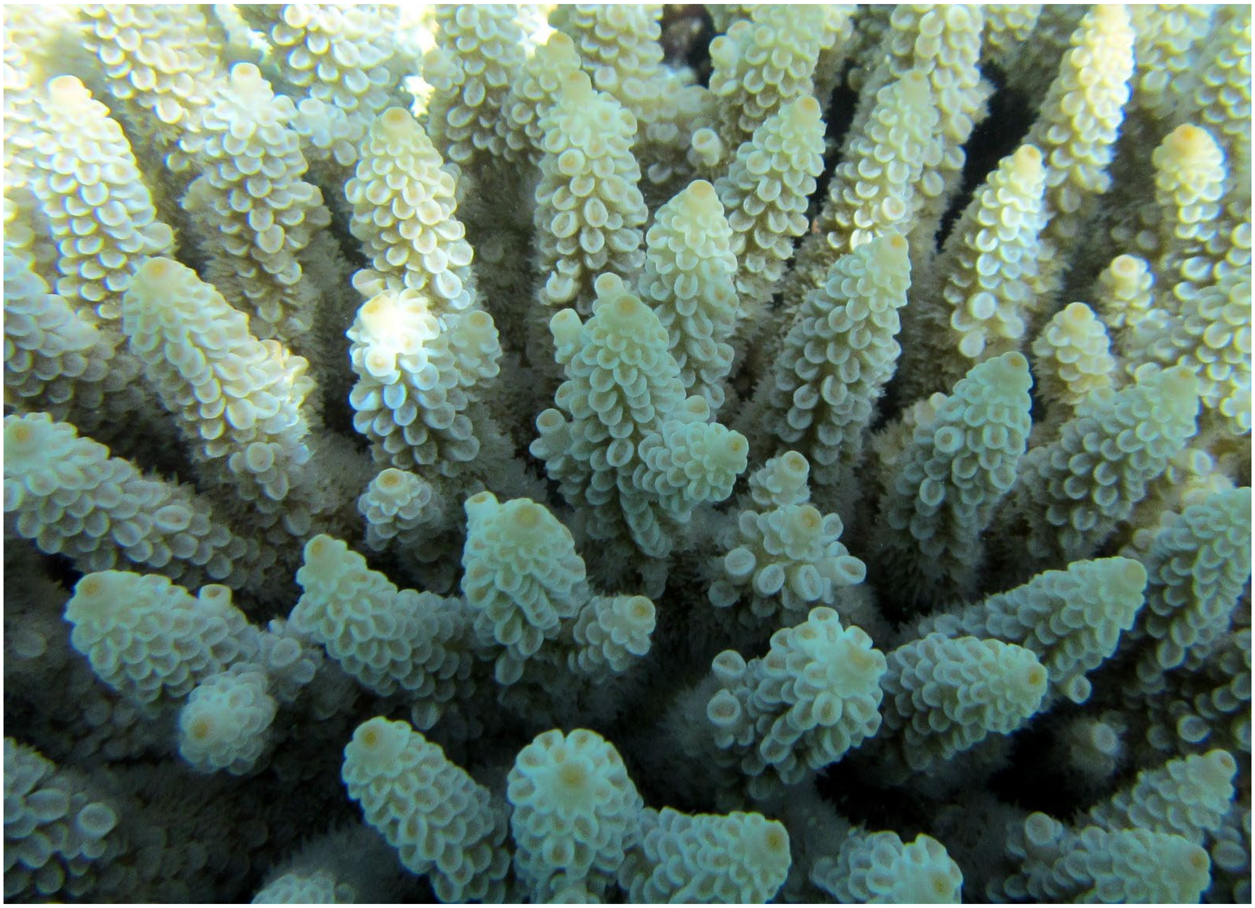
A close-up photo of *Acropora digitifera*. The radial corallites can be seen to be composed of only lower lips. On some branches, tiny black dots can be seen around the axial corallite. These are contracted black polyps; they are not seen in other species.

Acropora tenuis

This species forms cushion-shaped colonies composed of fairly thin vertical branches that are uniform in diameter and height. There are few if any side branches so it can be called “digitate.” The branch sides have obvious lower lips that can look leafy. The axial corallite is a small projecting tube. The branch tips are not blue like in *Acropora digitifera*, the branches may be thinner, the radial corallites are leafier, and it can be found at a variety of depths unlike *A. digitifera*.



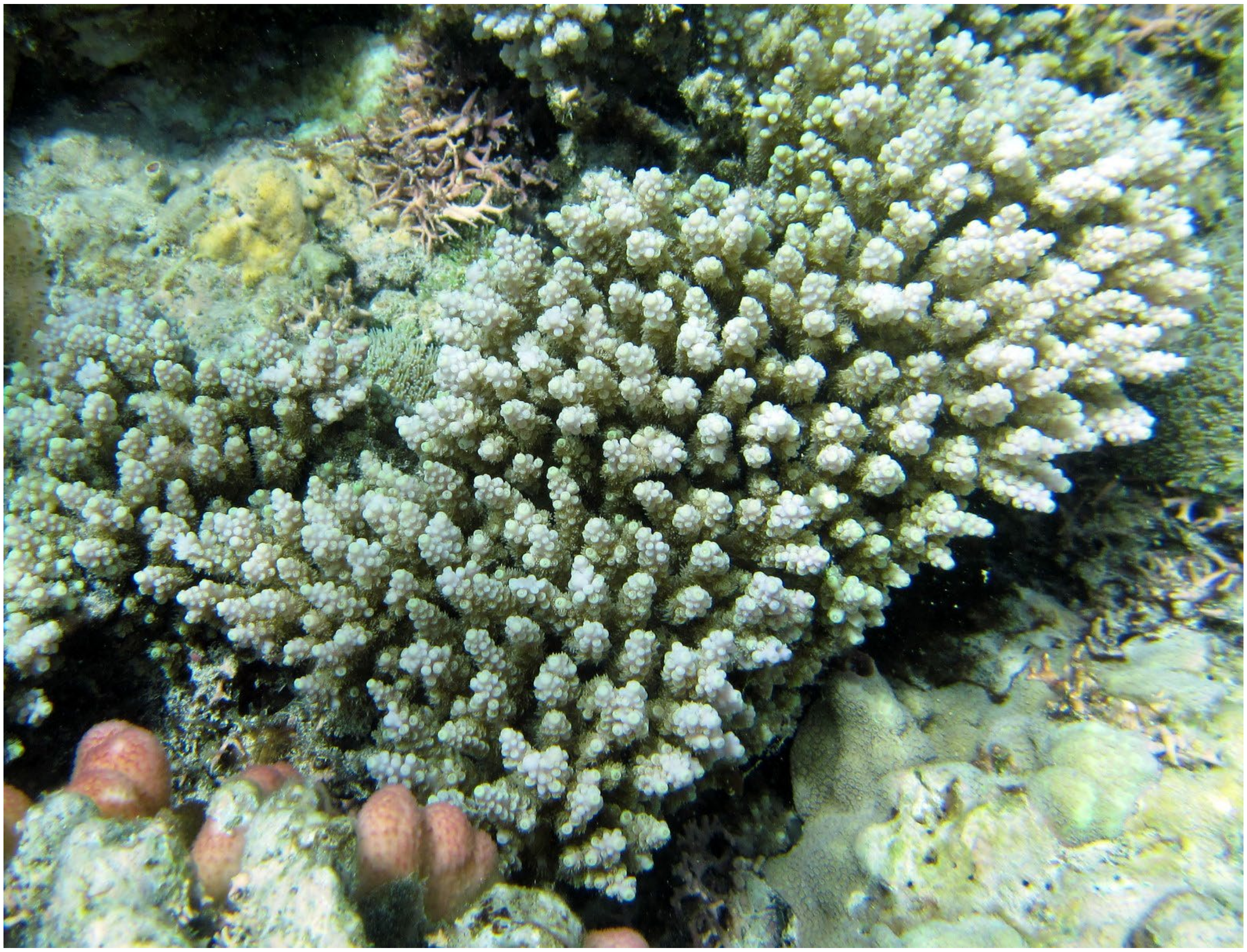
A colony of *Acropora tenuis*.



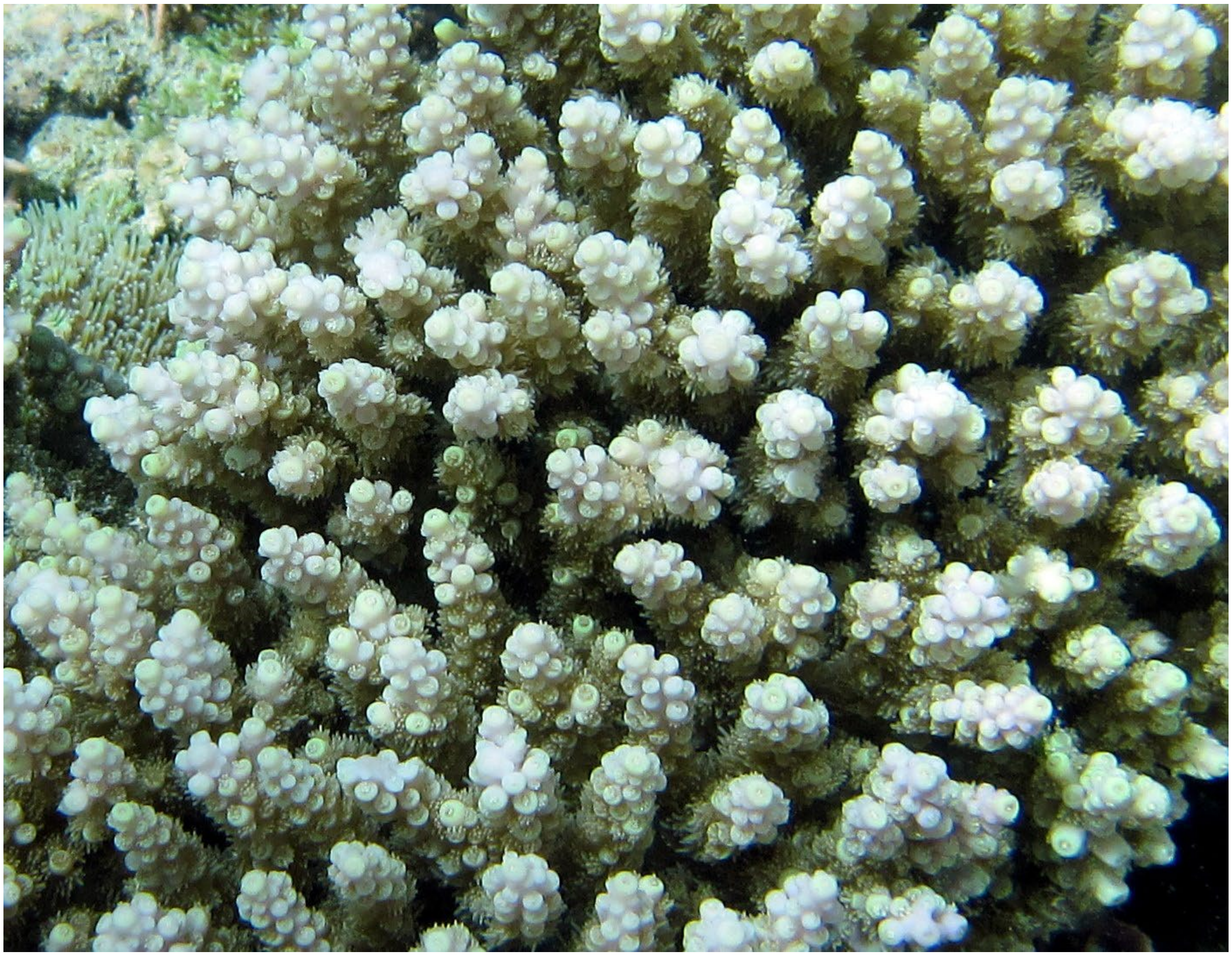
A close-up photo of *Acropora tenuis* showing the leafy or gutter-shaped lower lips of the radial corallites.

Acropora cf. chesterfieldensis

This species forms cushion-shaped colonies that have thin branches that may also be short. Most branches are vertical. The radial corallites are short tubes that usually face towards the ends of the branches. The axial is a small tube. Some of the tentacles may be partway extended. Branches are smaller and the radial corallites are much less leafy than on *Acropora digitifera* and *Acropora tenuis*.



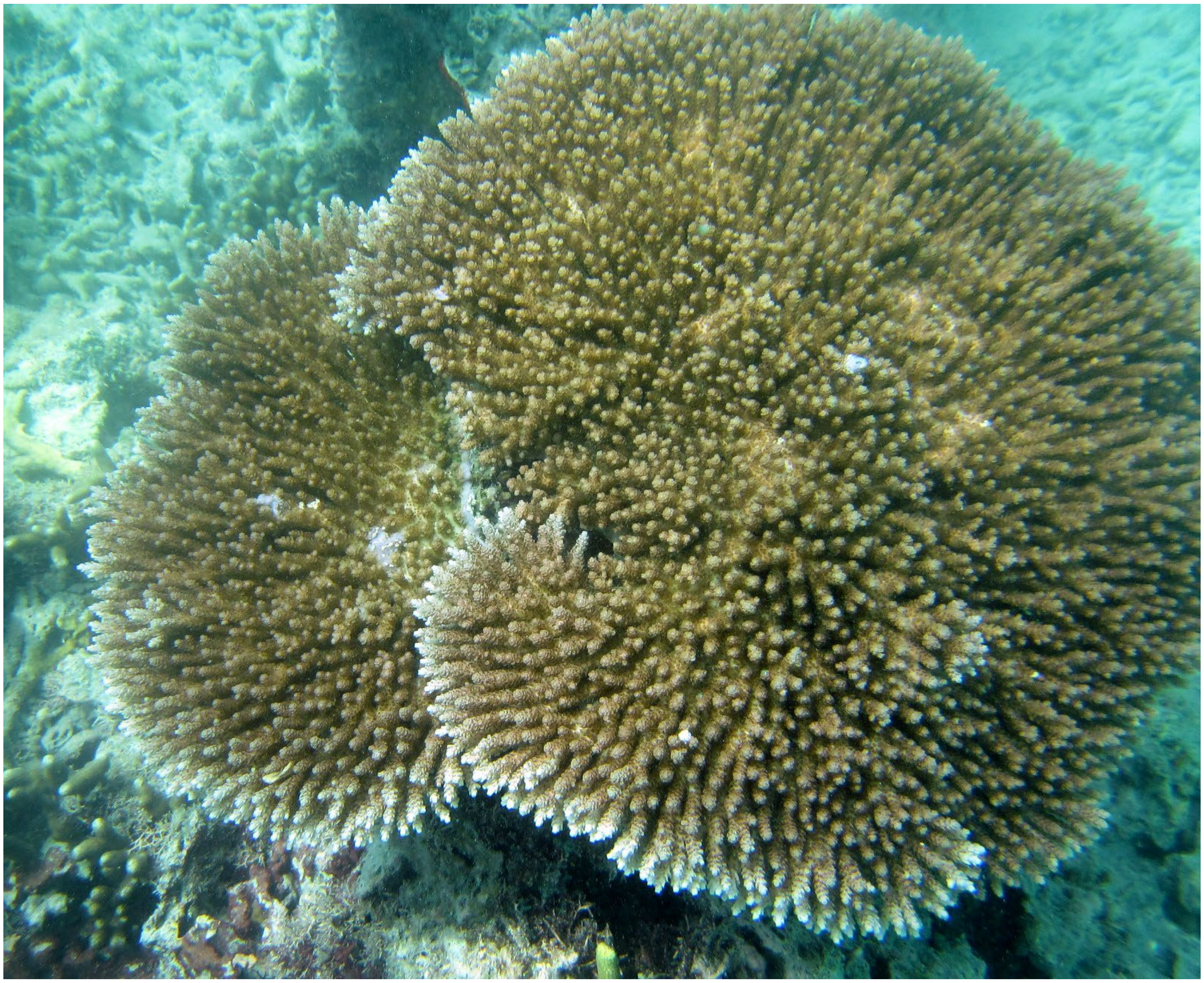
A colony of *Acropora chesterfieldensis*.



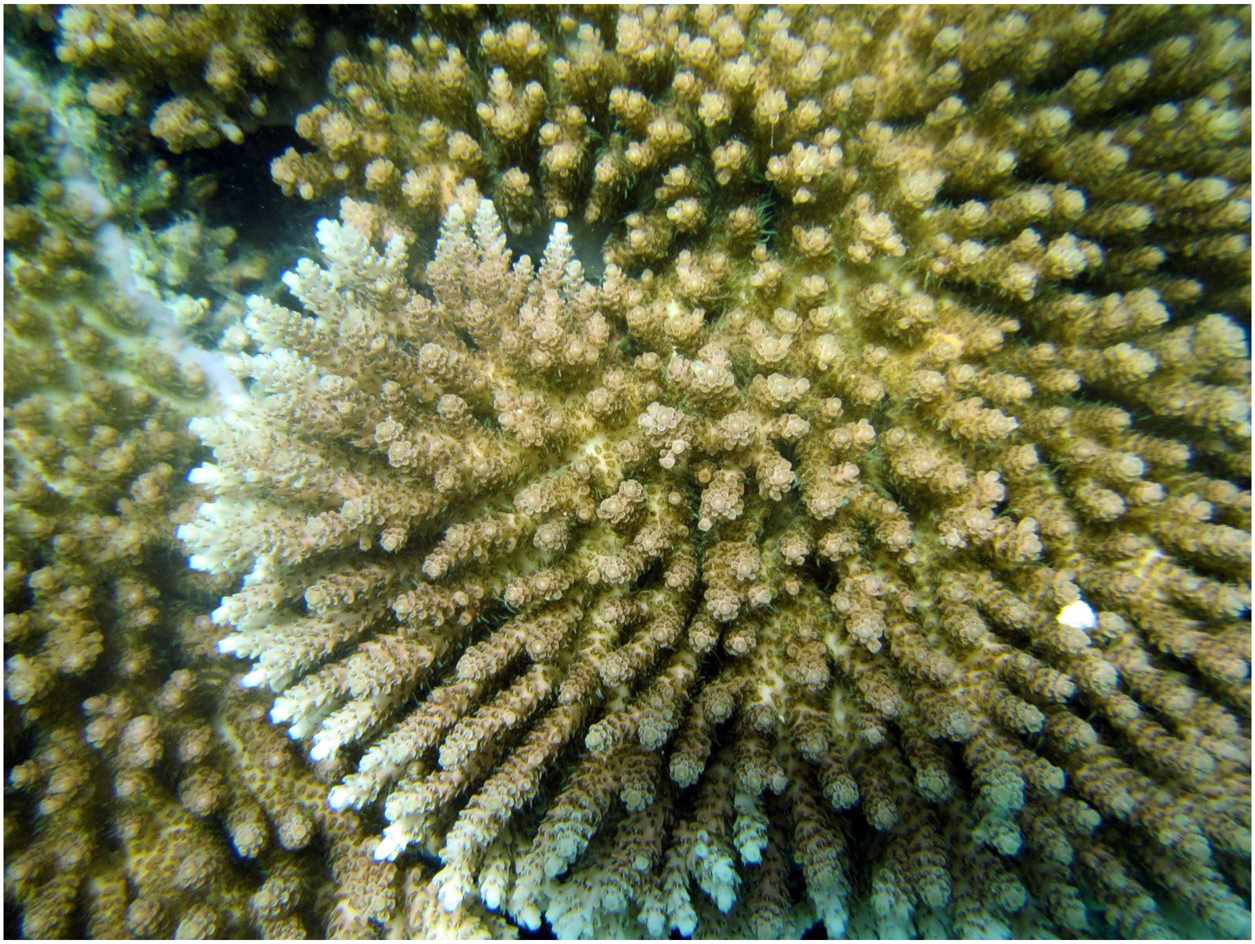
A close-up photo of *Acropora* cf. *chesterfieldensis* showing the radial corallites that are much less leafy than on *Acropora digitifera* and *Acropora tenuis*.

Acropora hyacinthus "table coral"

This species forms "table corals" which have a base, a column, and a top that spreads nearly flat into a circular tabletop shape. On the upper surface of the table there are small, vertical or nearly vertical branchlets. Each branchlet has a tiny axial corallite about 2 mm diameter, and radial corallites on the side of the branch that are like petals of a tiny flower, nearly flat and pointing upwards towards the end of the branch. The branchlets are thicker than on *Acropora cytherea*.



Two colonies of *Acropora hyacinthus* in the Blue Hole, side by side.



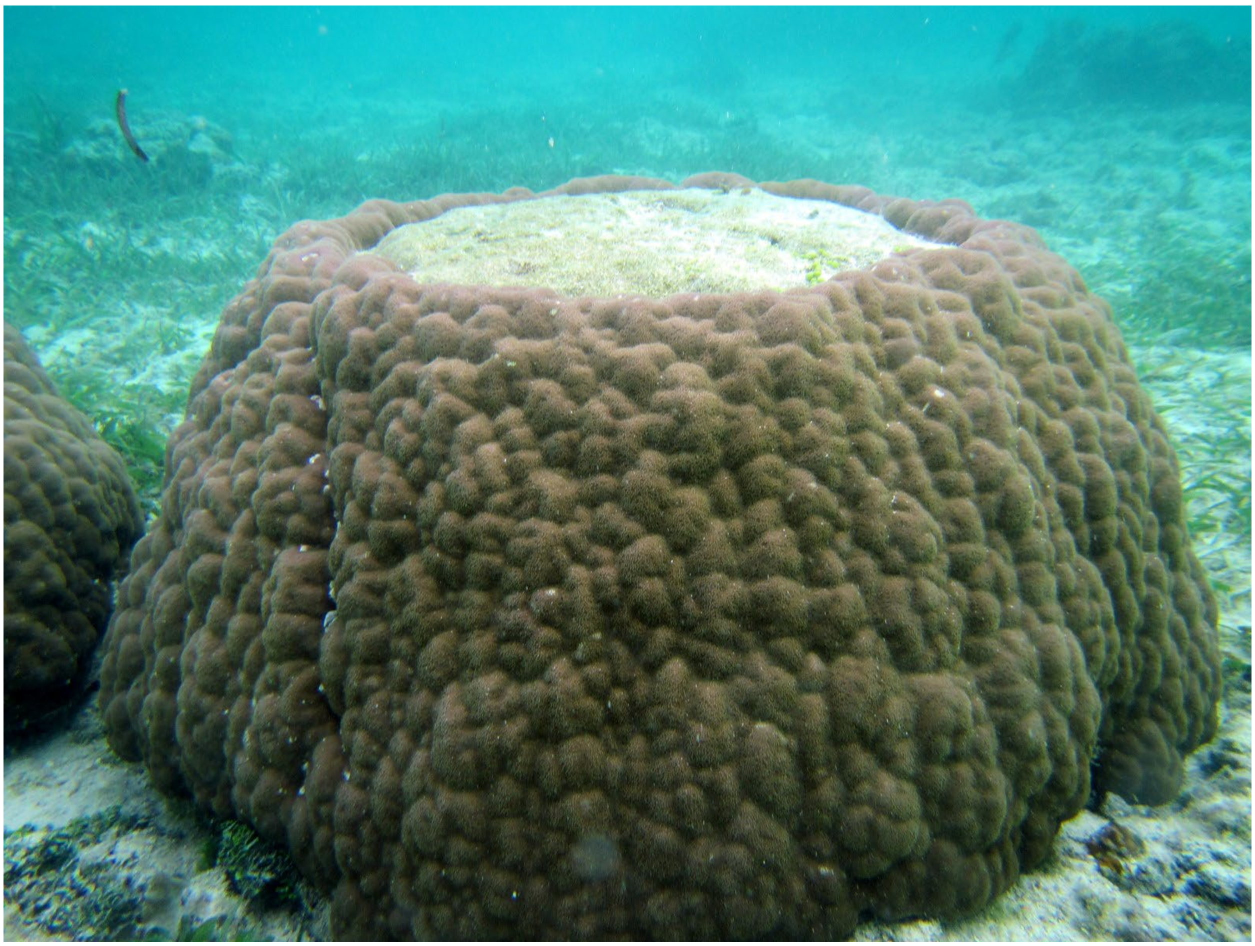
A close-up photo of *Acropora hyacinthus*, showing the branchlets, axial corallites, and radial corallites.

Porites

This genus forms colonies that can be massive, branching, columnar, or plating. The corallites are tiny, about 1 mm diameter. If the polyps are retracted, the corallites can look like tiny honeycomb. If tentacles are extended, then there can be a tiny ring of tentacles for each polyp, or a tuft of tentacles sticking out in the center of the corallite. A few species of *Montipora* can look like Porites, but *Montipora* usually has fine spines or little bumps. *Porites* never has spines but it can have small bumps between corallites. *Porites* also usually has corallites close together which *Montipora* usually doesn't have.

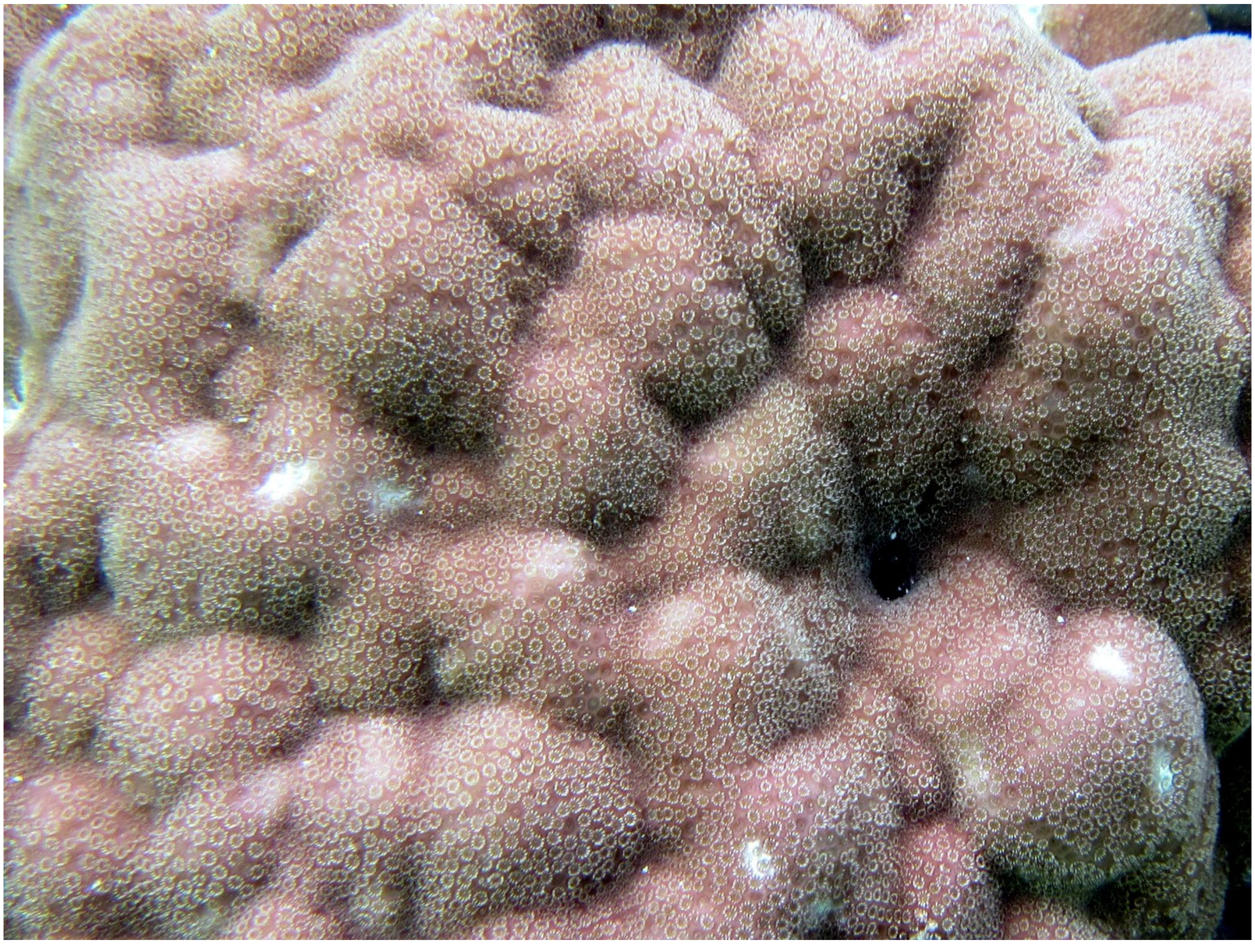
Porites "massive" (several possible species)

At least a half dozen species of *Porites* make dome or hemisphere-shaped colonies, which can get very large sometimes. We call these colonies "massive" whether they are large or small. Very few of the *Porites* massive colonies can be identified to species in the field at this point.



A moderately large *Porites* massive colony on a reef flat, with a top killed by low tide. A colony like this is called a "microatoll" because the living ring can grow higher than the dead center.

A smaller *Porites* massive colony. Massive *Porites* colonies are usually lumpy, some more than others.



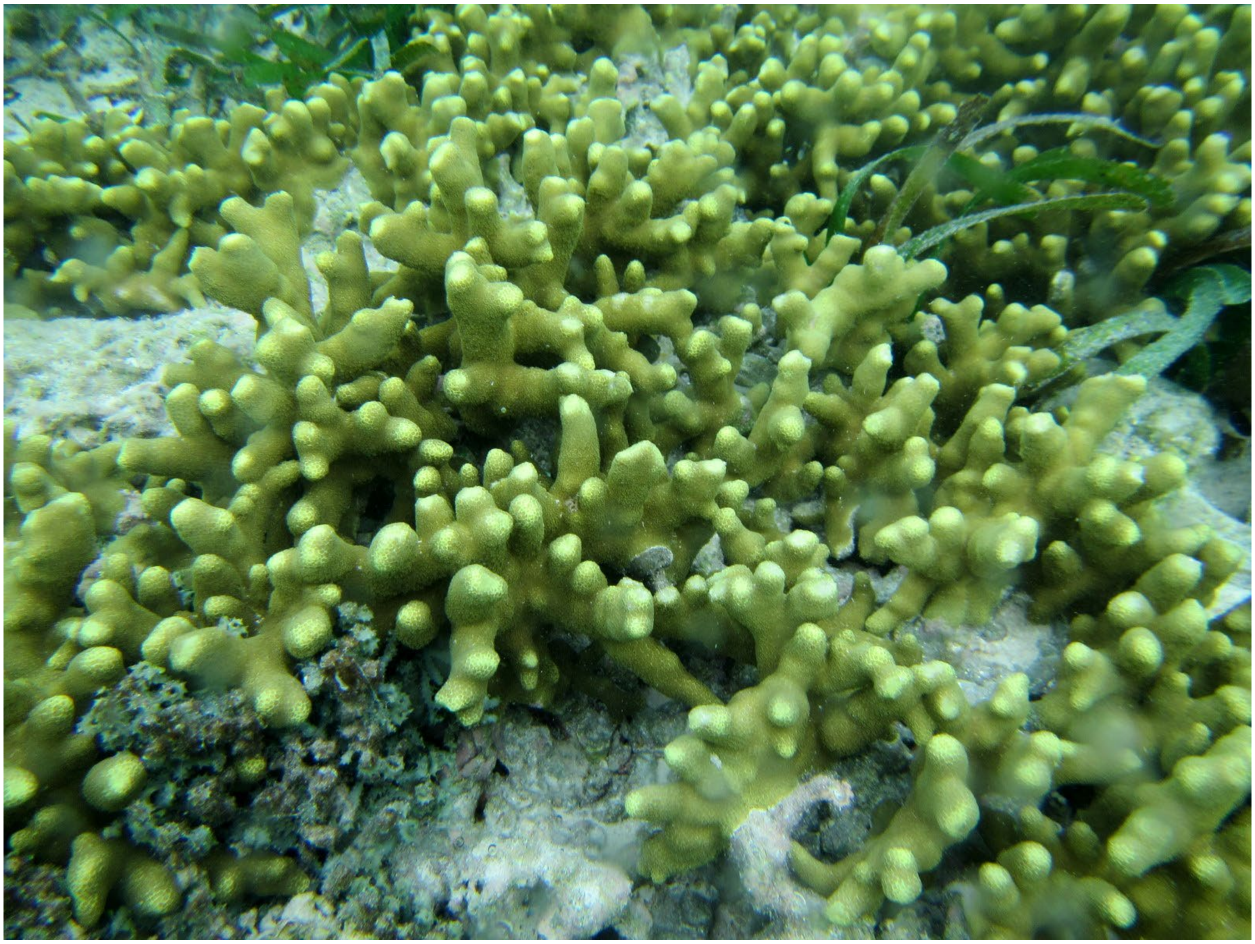
A close-up of the surface of a massive *Porites* colony. This colony had its tentacles out, which are the tiny rings. The polyps of *Porites* are usually about 1 mm in diameter, so tiny.

A close-up photo of a massive *Porites* colony, showing the tiny corallites. The polyps on this colony are pulled most of the way into the corallite, but there is a ring of tiny tentacles in each corallite.

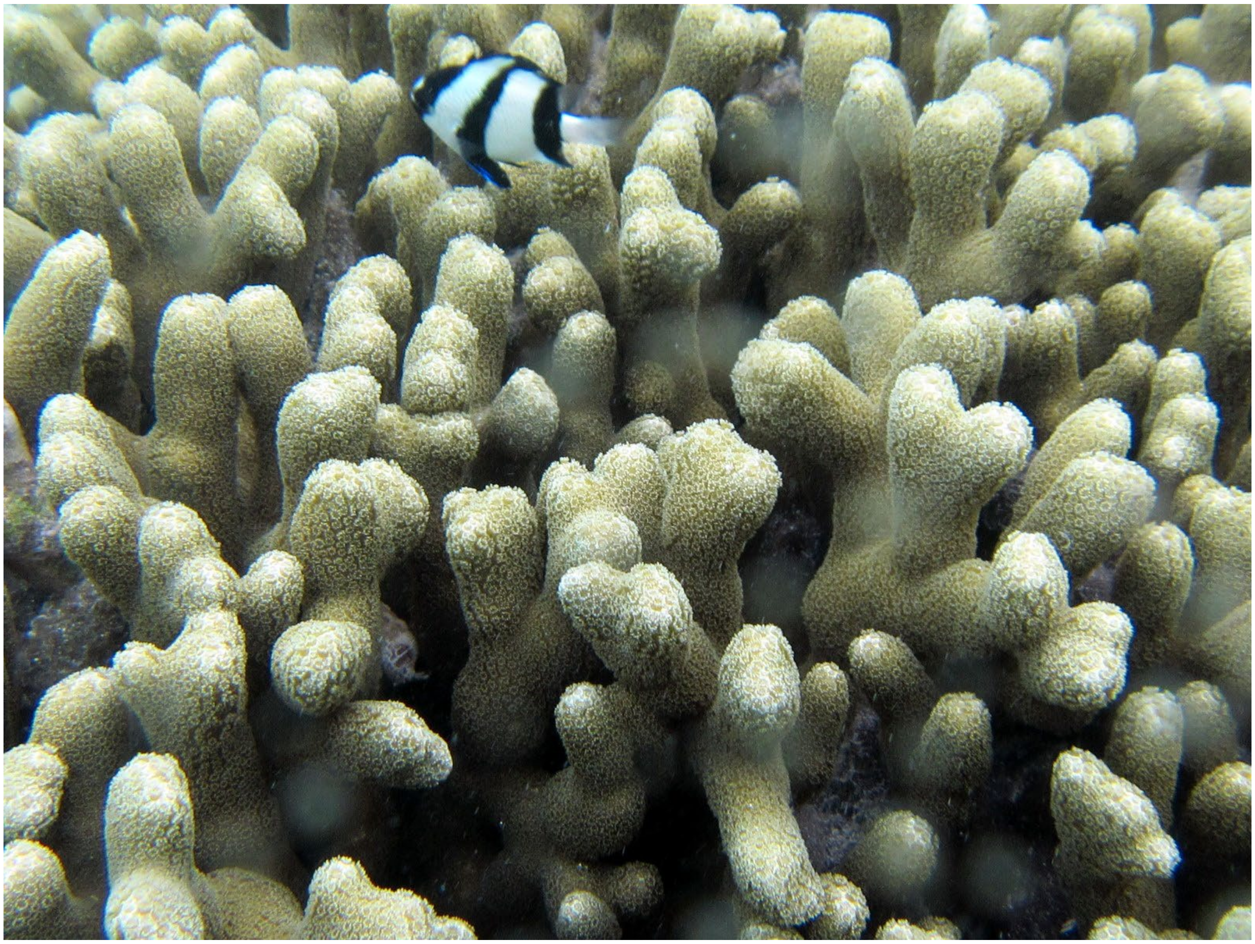
Porites cylindrica "finger coral"

This species forms colonies composed of smooth branches about the diameter of a finger or small finger. Branches are cylindrical and branch tips are rounded. There are many polyps on each branch tip. The polyps are tiny, about 1 mm diameter, and the tiny tentacles are often extended. Porites annae is brown and forms knobby columns with tentacles extended as tufts in the center of corallites and white tops of columns.

A colony of *Porites cylindrica*.



A colony with shorter branches.

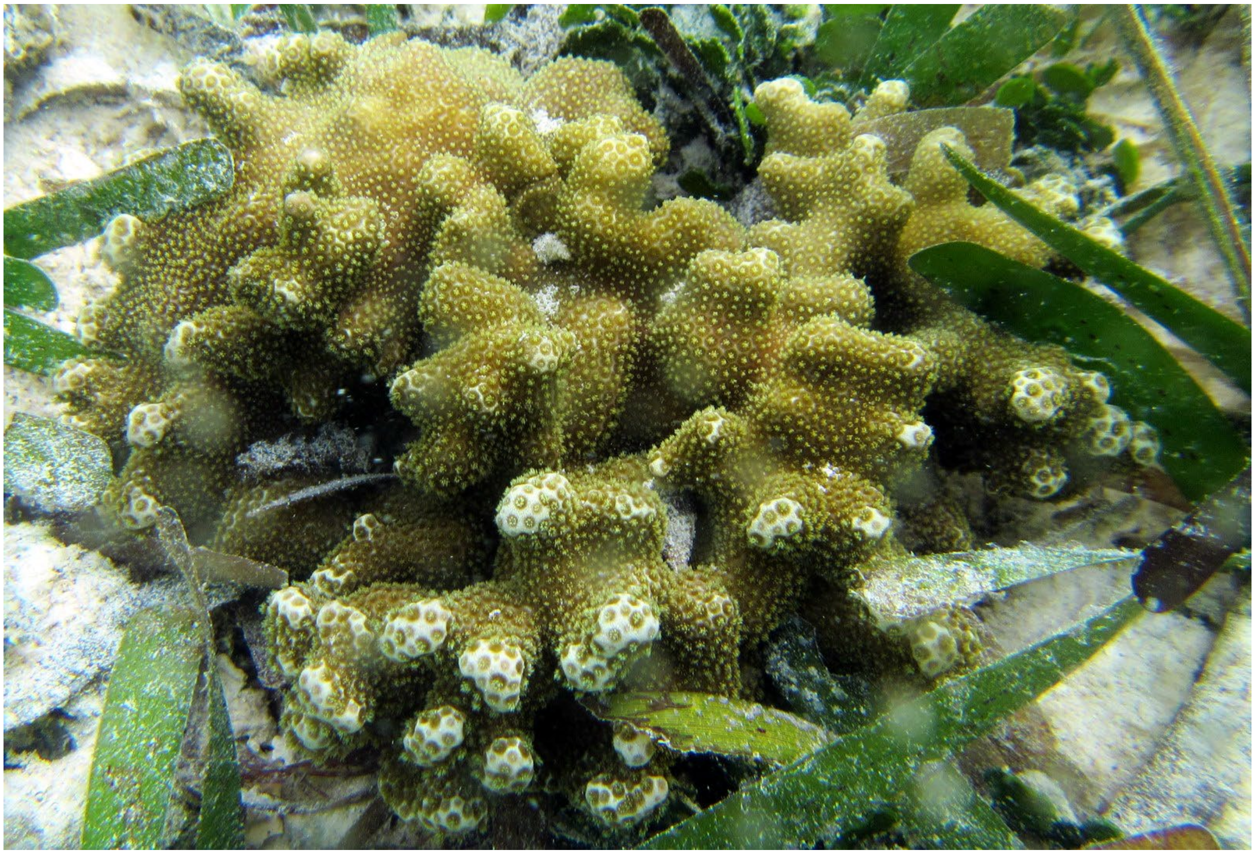


A close-up photo of *Porites cylindrica*, with the polyp tentacles extended.

Porites annae

This species forms small colonies that have columns or branches about 5-10 mm diameter. The branches or columns may be lumpy. Colonies are usually dark brown. The polyp tentacles are almost always extended, and are in a little tuft in the center of the corallite. On the top end of some columns or branches, the coral is white with polyps indented into the surface. *Porites cylindrica* forms branching colonies without an encrusting base and does not have white branch ends.

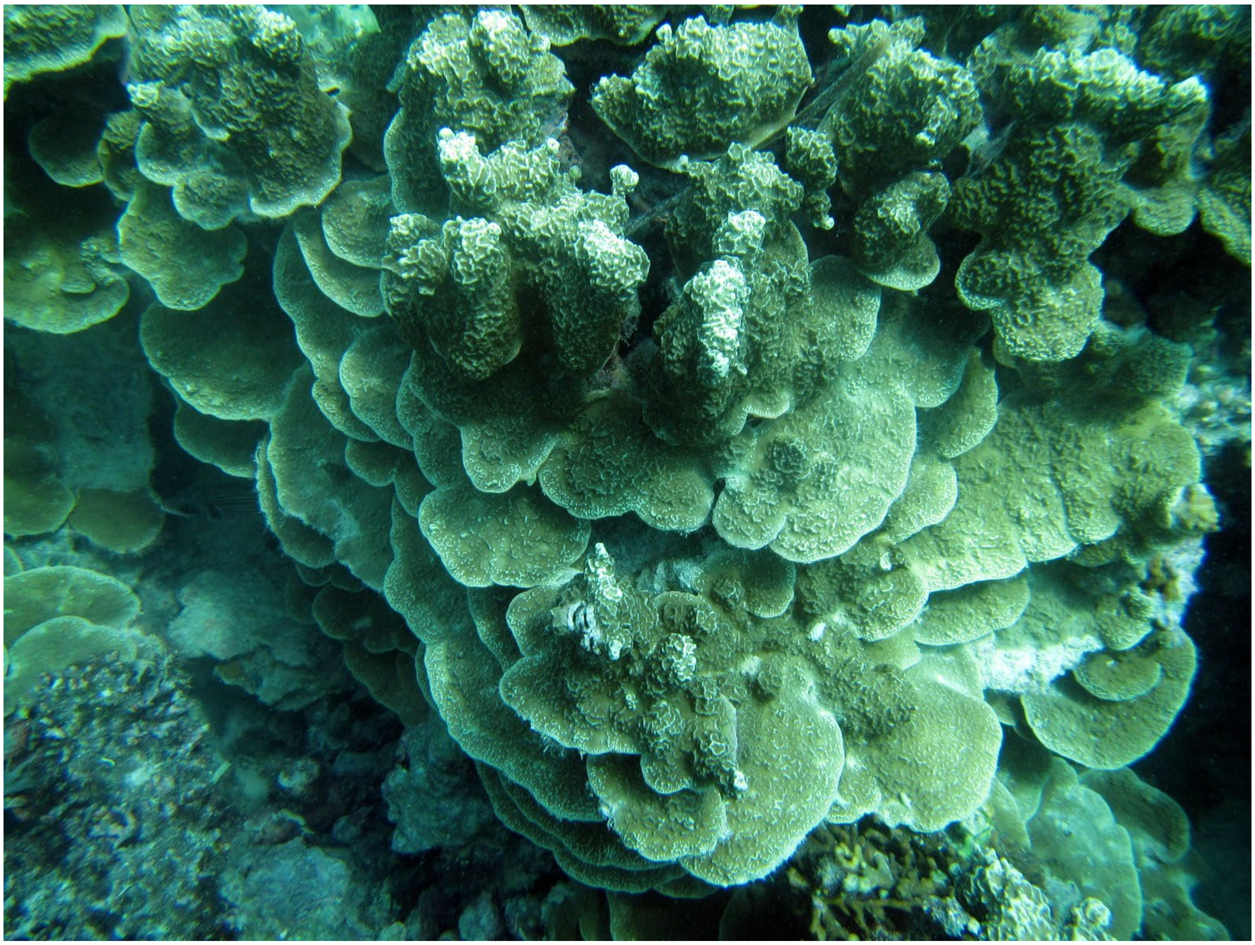
A colony of *Porites annae*.



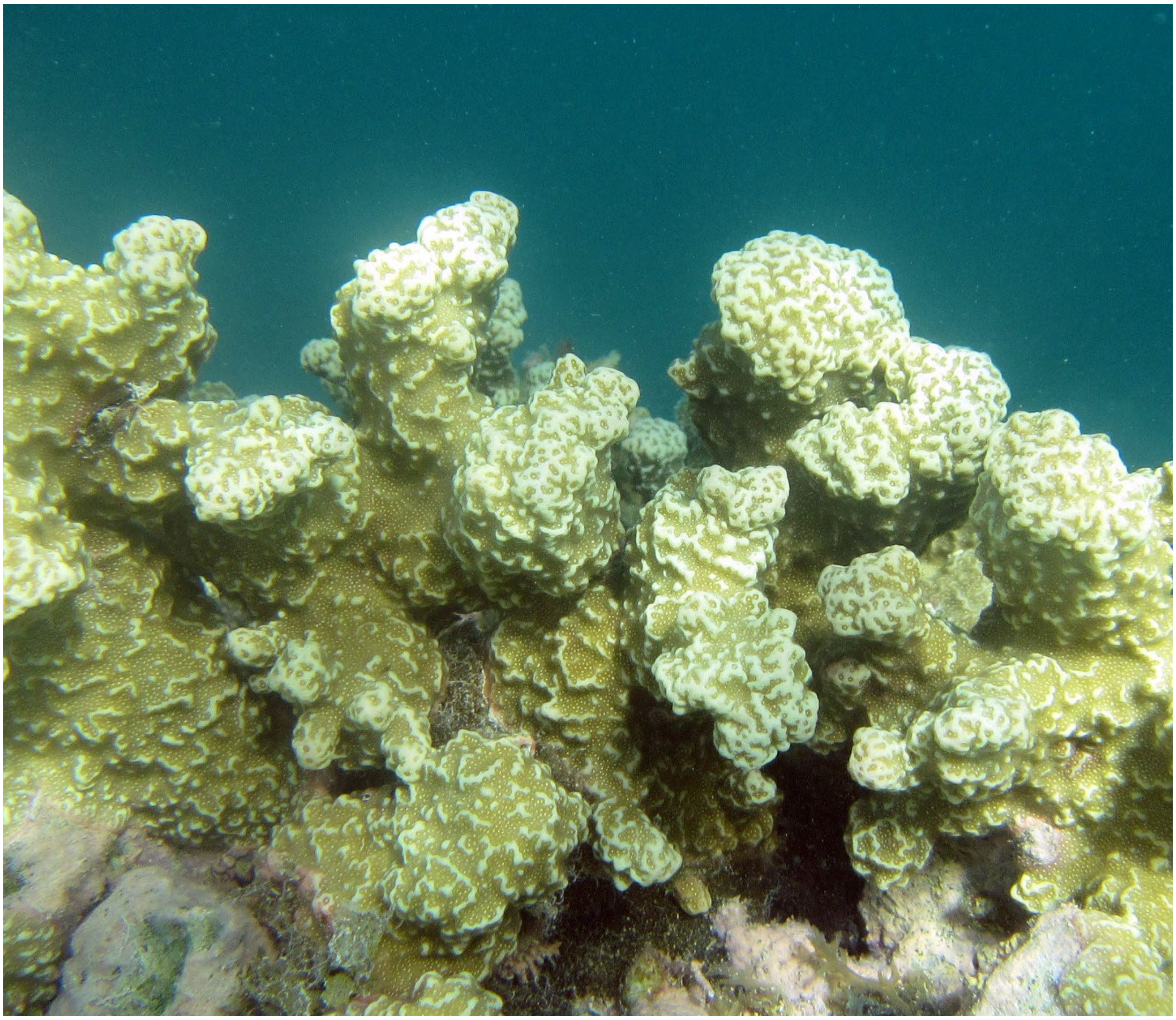
A colony in a seagrass bed on the reef flat.

Porites rus

This species forms colonies that are a combination of irregular columns, and/or thin plates. Colonies can have columns on the top and plates on the lower sides. Or colonies can be composed of only columns, and rarely colonies are only plates. The columns are bumpy, and the tops of columns have winding small white ridges, with tiny white dots between them, which are the polyps. The columns differ greatly in size between colonies, ranging from little finger diameter to wrist diameter. Plates are thin, near horizontal, and often have small ridges winding on their upper surface. *Porites annae* does not form thiin plates, has smaller, less irregular columns, does not form colonies as large, and doesn't have ridges on the surfaces.



A large colony of *Porites rus* with columns on top and thin horizontal plates on the lower sides.



A close-up of the tops of some columns on *Porites rus*, showing the winding white ridges and the tiny white dots between them that are the polyp centers.

Goniopora

This genus forms massive, columnar, or encrusting colonies. The polyps are usually extended, and are shaped like flowers such as daisies. They have a long column (like a stem) and radiating tentacles at the end (like petals). In some species the polyps can be up to about 6 inches long, with a ring of tentacles up to about 1 cm diameter. But there is a wide range of polyp sizes in different species, and some species have polyps that are only about twice the size of *Porites* polyps. Polyps have 24 tentacles. *Alveopora* looks very similar, but has 12 tentacles. It is nearly impossible to count tentacles underwater, and difficult to count them in photos. *Goniopora* has a very hard skeleton, Alveopora has a very soft skeleton. A finger nail will sink into an *Alveopora* skeleton, but not into a *Goniopora* skeleton.

Goniopora sp. 1

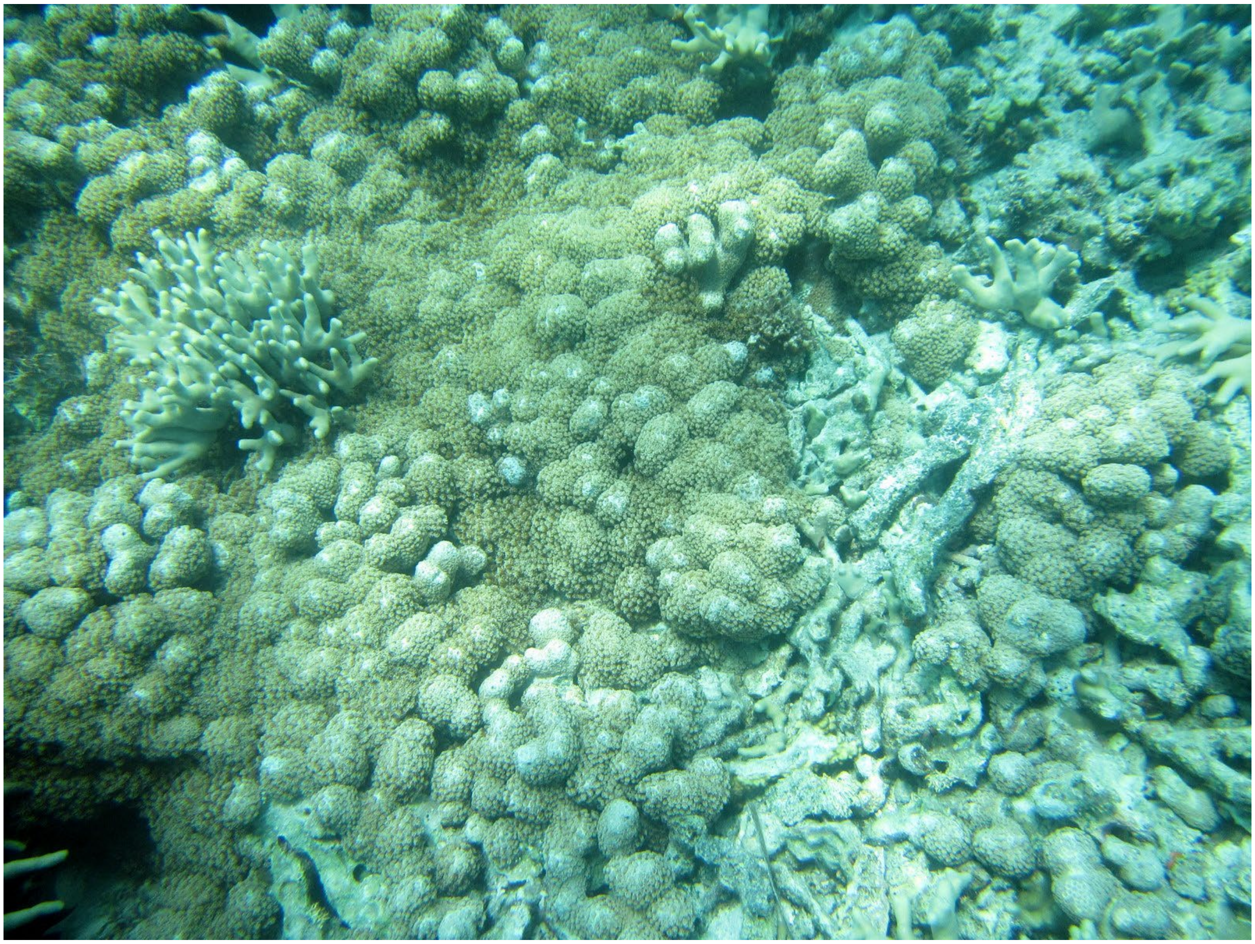
This species forms what appear to be massive colonies and has polyps that are about 3 cm long, with columns about 2-3 mm diameter. The smooth area within the ring of tentacles is small. Polyps are brown and have a light blue area in the center of the ring of tentacles. It appears that colonies are probably branching or columnar, but the polyps cover and hide the branches or columns. *Goniopora* sp. 3 has more obvious branches and smaller polyps.

A large field of *Goniopora* sp. 1.

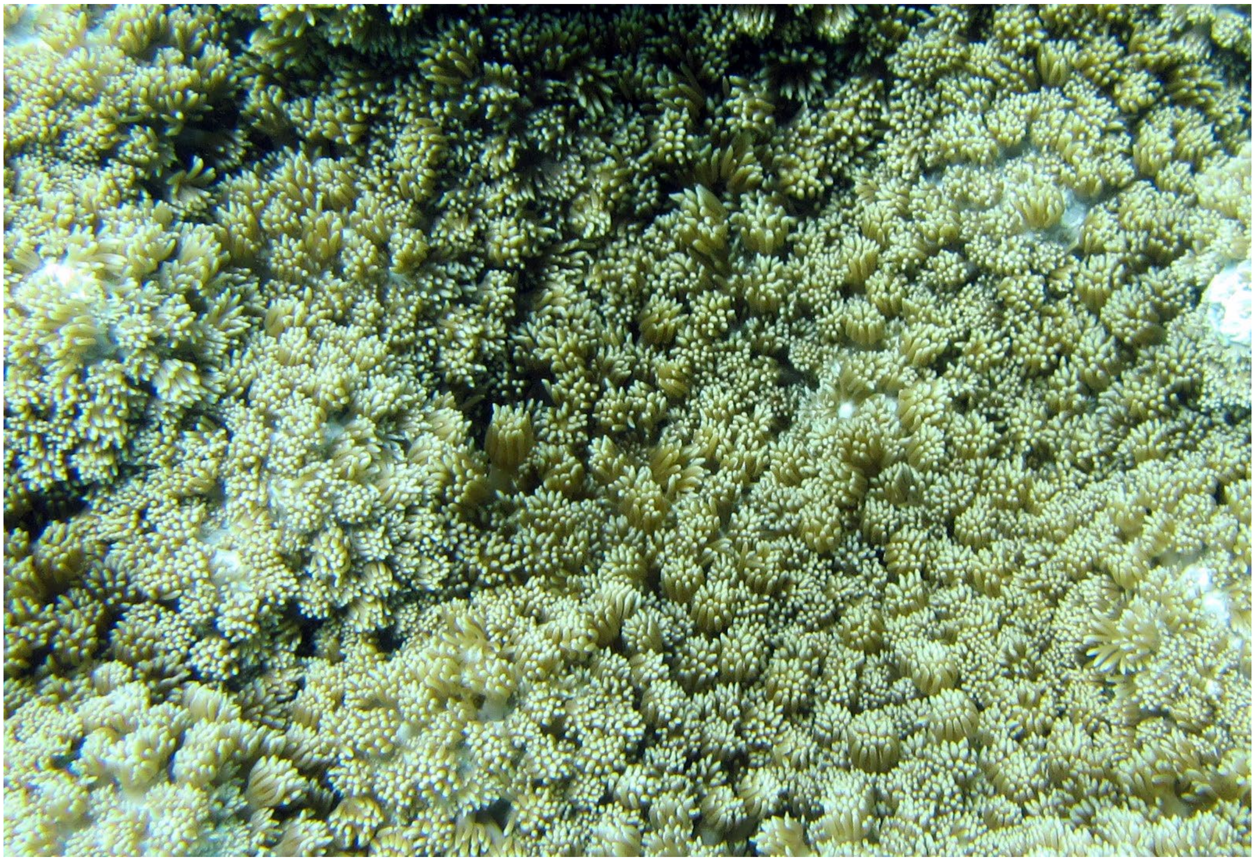
A close-up of *Goniopora* sp. 1 polyps.

Goniopora sp. 3

This species forms branches or columns with polyps that are small and don't extend far. It is not yet clear which species this is. This species has more obvious branches and smaller polyps than *Goniopora* sp. 1.



A branching or columnar *Goniopora* sp. 3 colony.

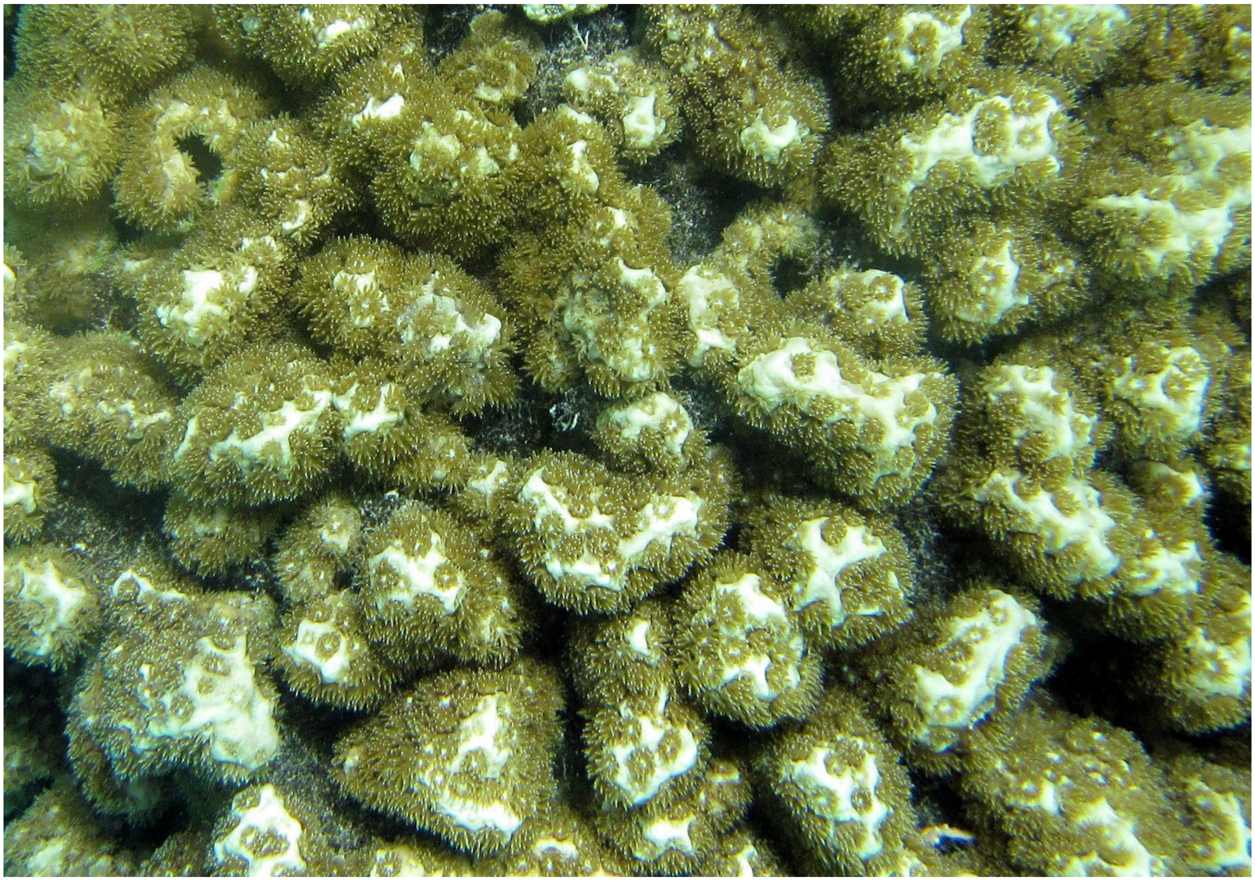


A close-up photo of *Goniopora* sp. 3 showing the tentacles. The polyp column may be short on this species, or it may be retracted.

Goniopora sp. 2

This species forms small colonies of small, short branches. The polyps are small and only the tentacles are extended. On the tops of branches there are places where the polyps are separated widely. The tentacles are greenish brown and the spaces between them white. The branches on this species are much smaller than on *Goniopora* sp. 1 and 3, and the polyps are smaller, and it has large white spaces between polyps.

A colony of *Goniopora* sp. 2.



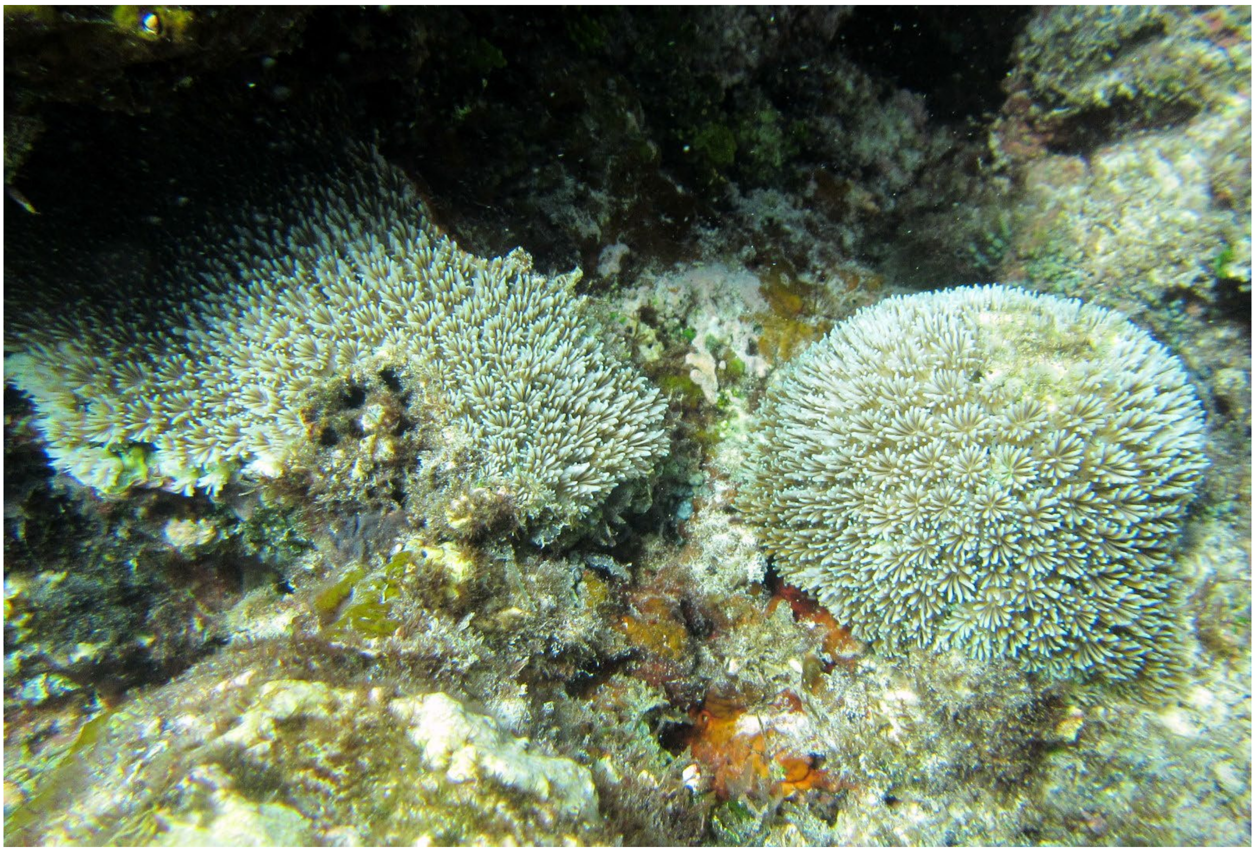
A close-up photo of *Goniopora* sp. 2.

Galaxea

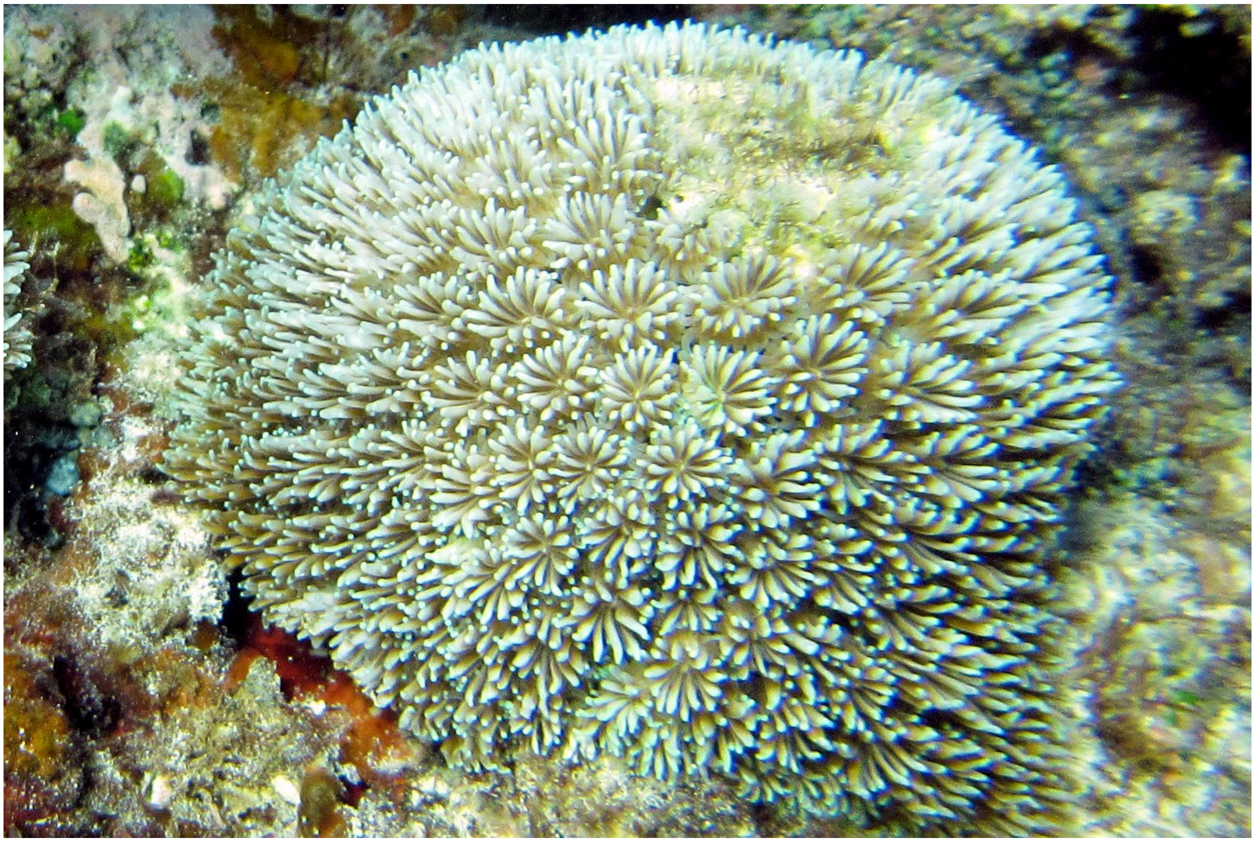
This genus forms colonies that can be encrusting, massive, or branching. The corallites in different species range from about the diameter of a small finger to just a few millemeters diameter. The corallites have septa that project well above the rim of the corallite as a ring of spines. Colors are usually gray, brown or bright green. No other genus has such spiky corallites.

Galaxea fascicularis

This species forms small encrusting colonies that have corallites about the diameter of a small or medium finger, with a ring of projecting septa around the edge of the corallite that look like spines. Galaxea astreata has smaller corallites.



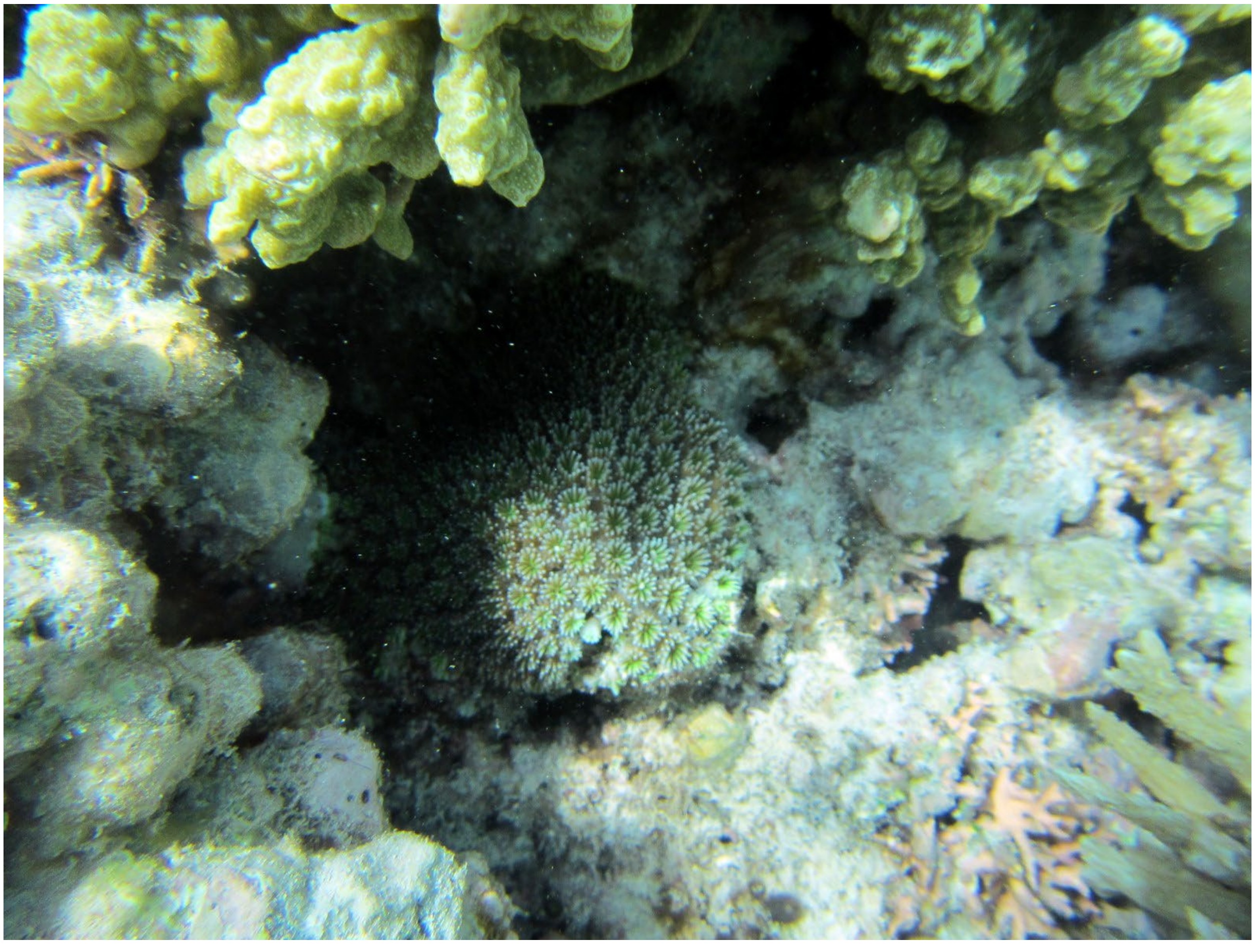
Two colonies of *Galaxea fascicularis*.



A close-up photo of *Galaxea fascicularis*, showing the corallites with a ring of septa that project as spines.

Galaxea astreata Vulnerable

This species forms small encrusting colonies that have corallites a bit smaller than the diameter of a little finger. Septa project from the edge of the corallites forming what looks like a ring of spines. Colonies are gray, brown, or bright green. Corallites are smaller than on *Galaxea fascicularis*.



A colony of *Galaxea astreata*. Close-up it looks the same as *G. fascicularis*, except the corallites are smaller.

Psammocora

This genus forms branching, columnar, or encrusting colonies that have corallites that are often not visible under water. They may have small or tiny tentacles projecting, or not. Corallites are harder to see than on other genera.

Psammocora contigua

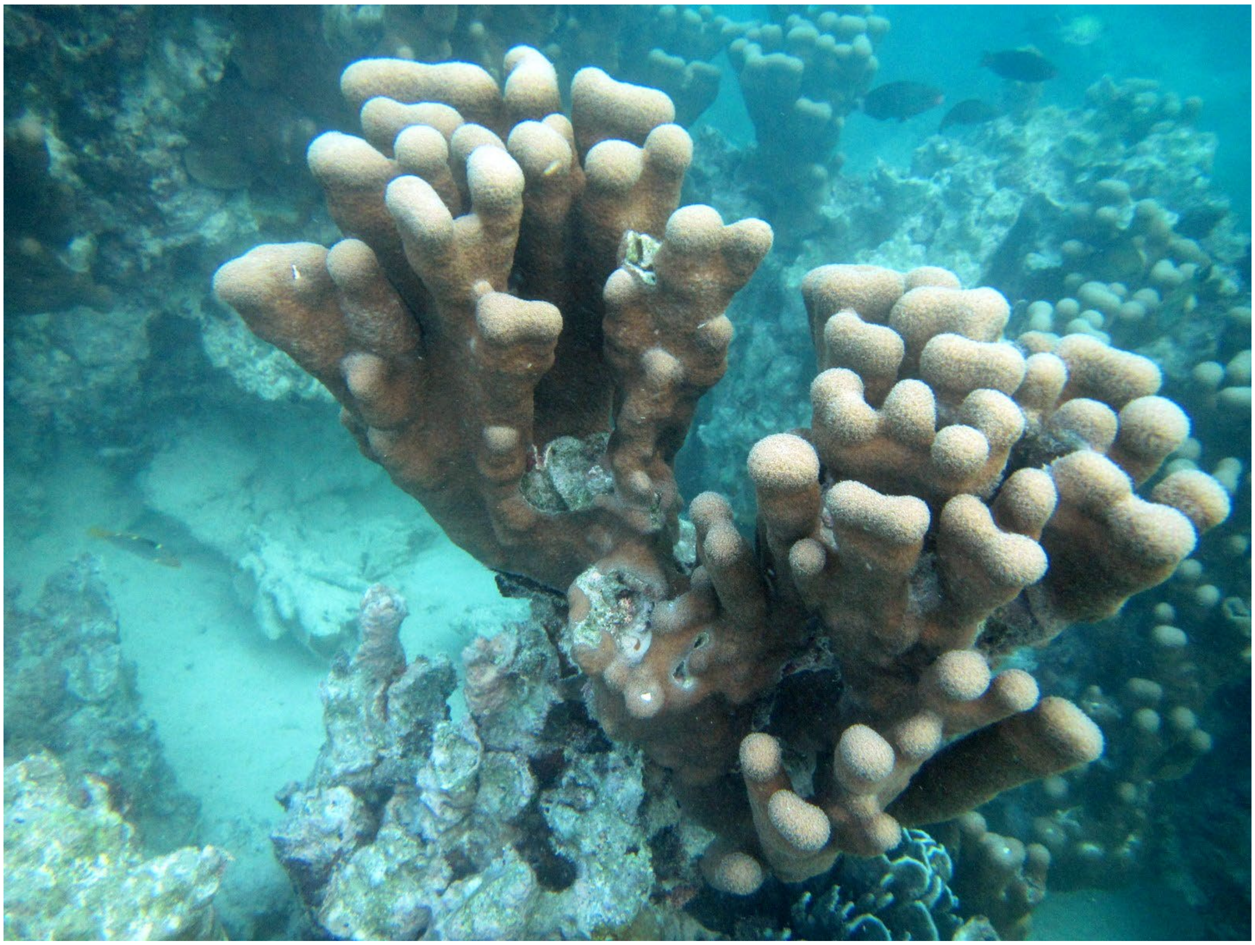
This species forms branching colonies on the reef flats. The branches are a bit lumpy, but when examined closely no corallites can be seen. Colonies are brown and branch ends are usually lighter than the rest of the colony. This species has thinner branches than other species of *Psammocora*. Branching *Montipora* has visible tiny polyps.

A colony of *Psammocora contigua*.

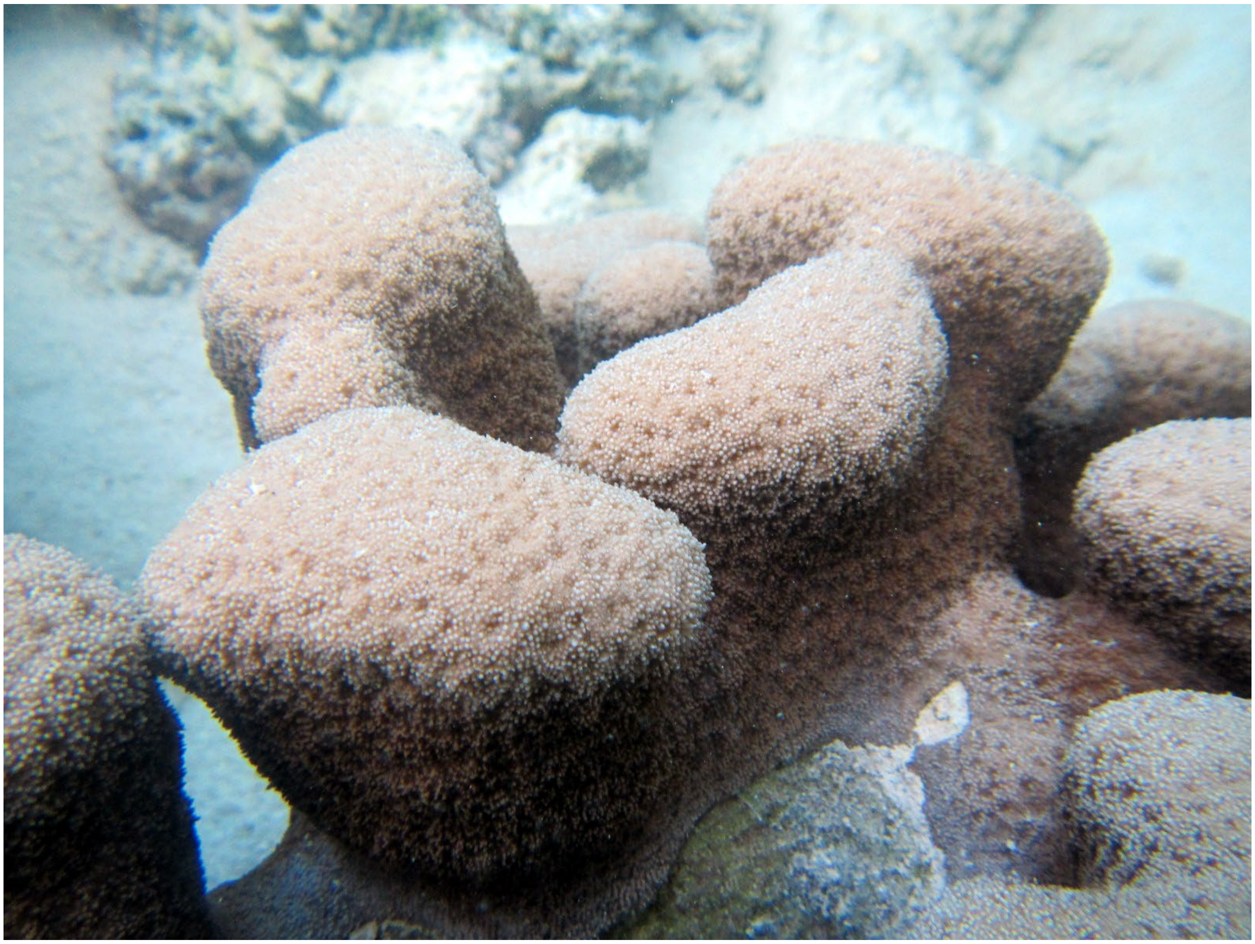
A close-up of a colony of *Psammocora contigua*. A very fine fuzz on branches is the tiny tentacles, but this is hard to see under water.

Psammocora haimiana

This species forms sturdy columns, about the diameter of a wrist, with rounded tops that usually are the same height in a colony. Colonies can be anything from less than a foot tall to at least 6 feet tall, and have anything from a few to many columns. The columns are covered with small tentacles and are dark brown. The columns are taller and more uniform than on *Scapophyllia cylindrica*, divide some, and do not have ridges. The columns are more uniform and rounded than on any other *Psammocora*. The surface is very similar to *Psammocora digitata*, which is massive and only rarely has tapering columns. *Coscinaraea exesa* has much more obvious corallites.



A colony of *Pammocora haimeana*.



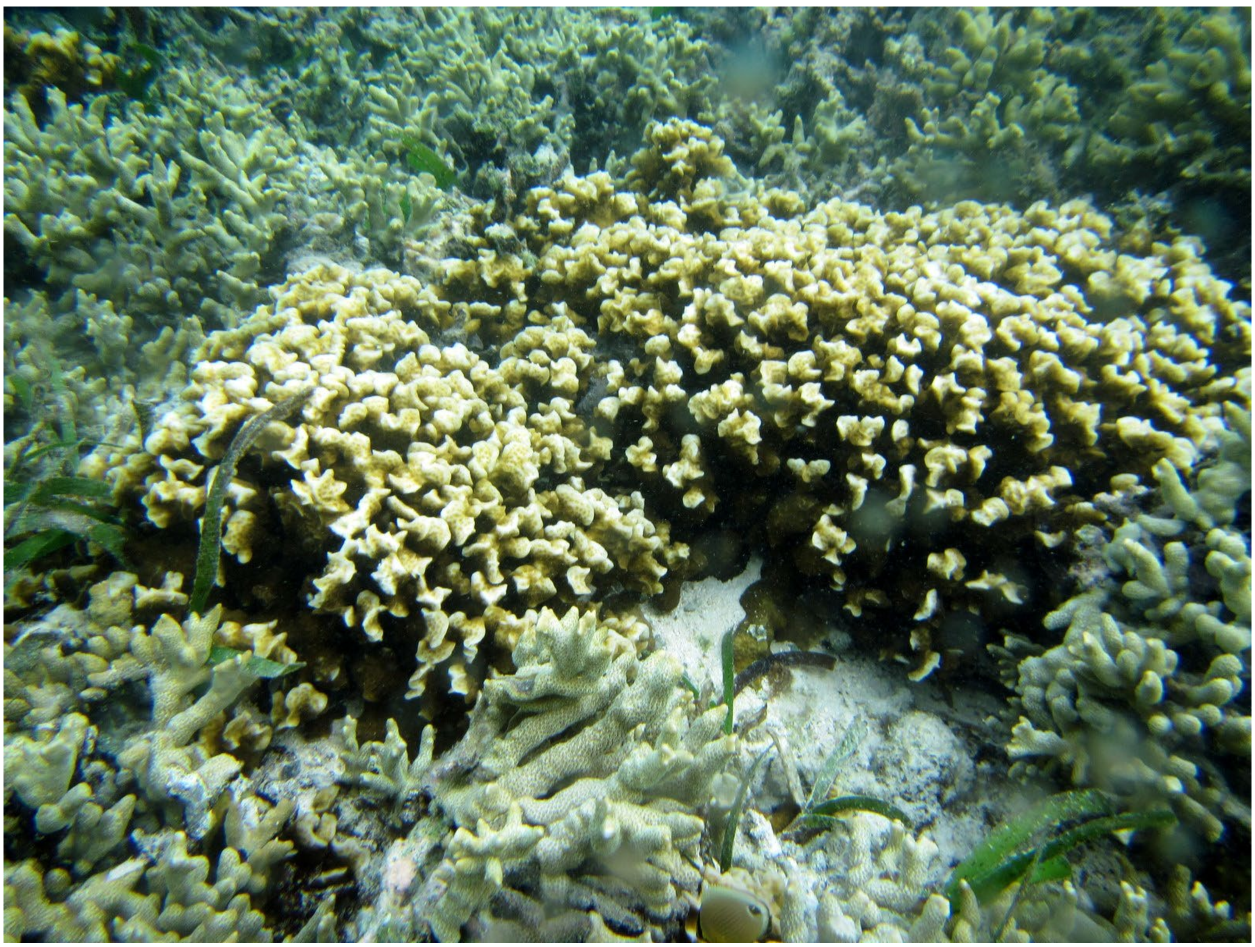
A close-up photo of *Psammocora haimeana*. The surface has small slight depressions that are corallite centers, and tiny bumps that are skeleton bumps or tentacles.

Pavona

This genus is hard to define. It has little ridges called "septa" inside each corallite which continue up and over the corallite wall and continue on to the next corallite and up over the wall into that corallite. The walls of corallites are often not well defined. Often the corallites are small enough that it is quite hard to see these ridges. Colonies can be massive, thick vertical plates, encrusting, thin plates or vertical leaves, or crinkly intersections of vertical plates and ridges. *Leptoseris* has the same sort of septo-costae, but usually forms thin plates and sometimes is encrusting. *Leptoseris* is usually in low light while *Pavona* is in well-lit locations.

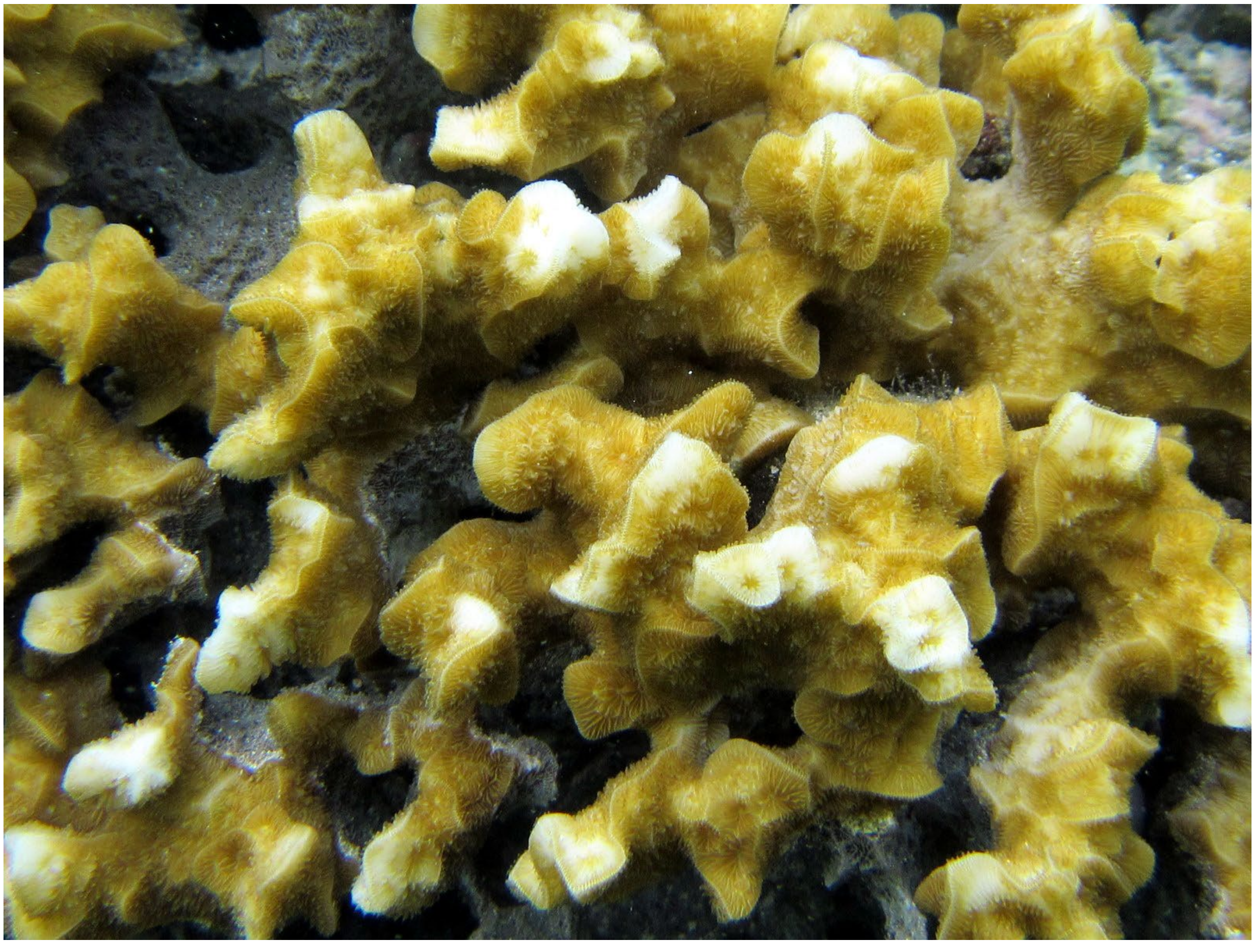
Pavona frondifera

This species forms rounded masses of branches that have lots of ridges on them and lots of twists and irregularities. It is almost always a golden color and often has white ends on the branches. *Pavona decussata* forms smoother plates which can be much larger, and usually has tentacle extended. *Pavona danai* looks similar and is twisted but does not have side plates.



A colony of *Pavona frondifera* from a distance.

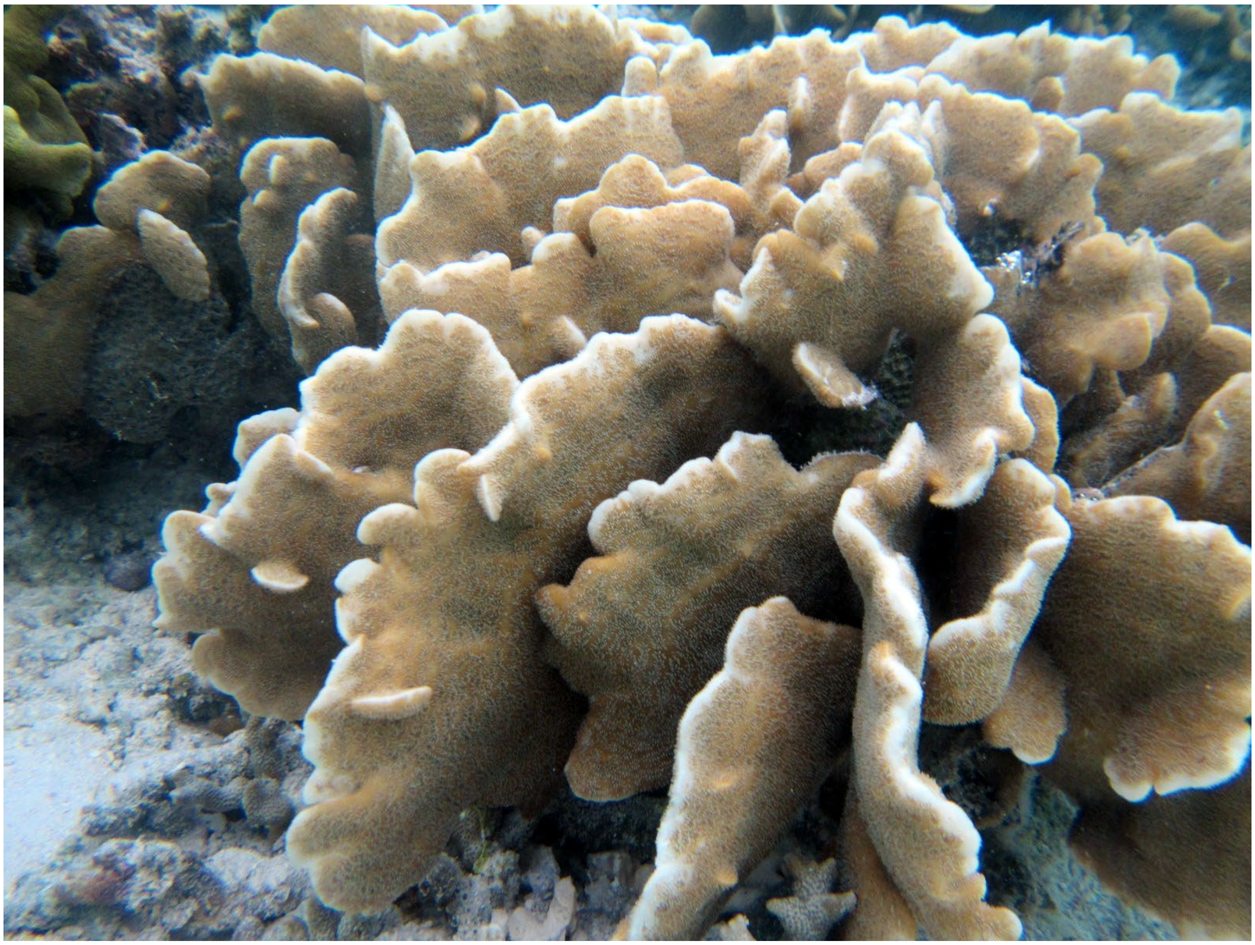
Closer to a colony of *Pavona frondifera*.



A close-up photo of a colony.

Pavona decussata Vulnerable

This species forms colonies that are vertical plates, with very few side plates or ridges. Plates can be up to 6 inches across but are usually smaller and can be as little as an inch or less across. The surfaces are usually covered with fairly long tentacles and so fuzzy. Usually a light tan color. Much less crinkly than *Pavona frondifera*, with fewer side plates.



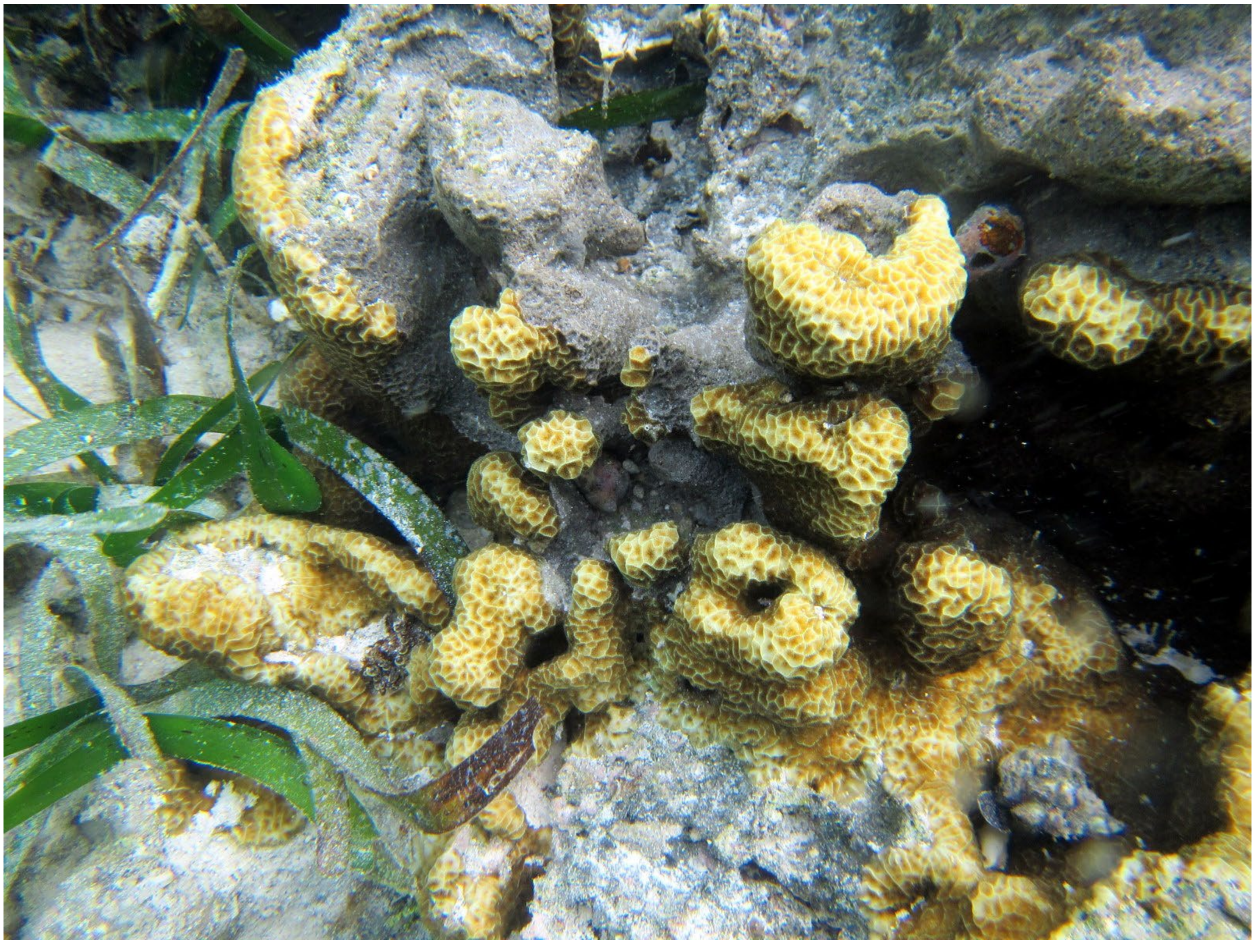
A colony with many large plates.

A colony with both small and large plates.

This photo shows *Pavona decussata* on the left, and *Pavona frondifera* on the right.

Pavona venosa Vulnerable

This species forms lumpy colonies that have a golden color. The corallites are recessed in between sharp ridges, which surround them. Found on the reef flat. The ridges are sharper than on *Psammocora profundacella*, which forms small coloniiies. The corallites are more irregular in shape than on *Gardineroseris planulata*, which can form larger colonies that are not lumpy.



A colony of *Pavona venosa*.

A close-up photo of a colony of *Pavona venosa*. The corallites only have tiny septa visible along the edge.

Pavona varians

This species forms massive or encrusting colonies with winding ridges that have tiny ridges (septa) running up and down their sides. This is named after variable morphology and likely to be a species complex.

A colony of *Pavona varians*.

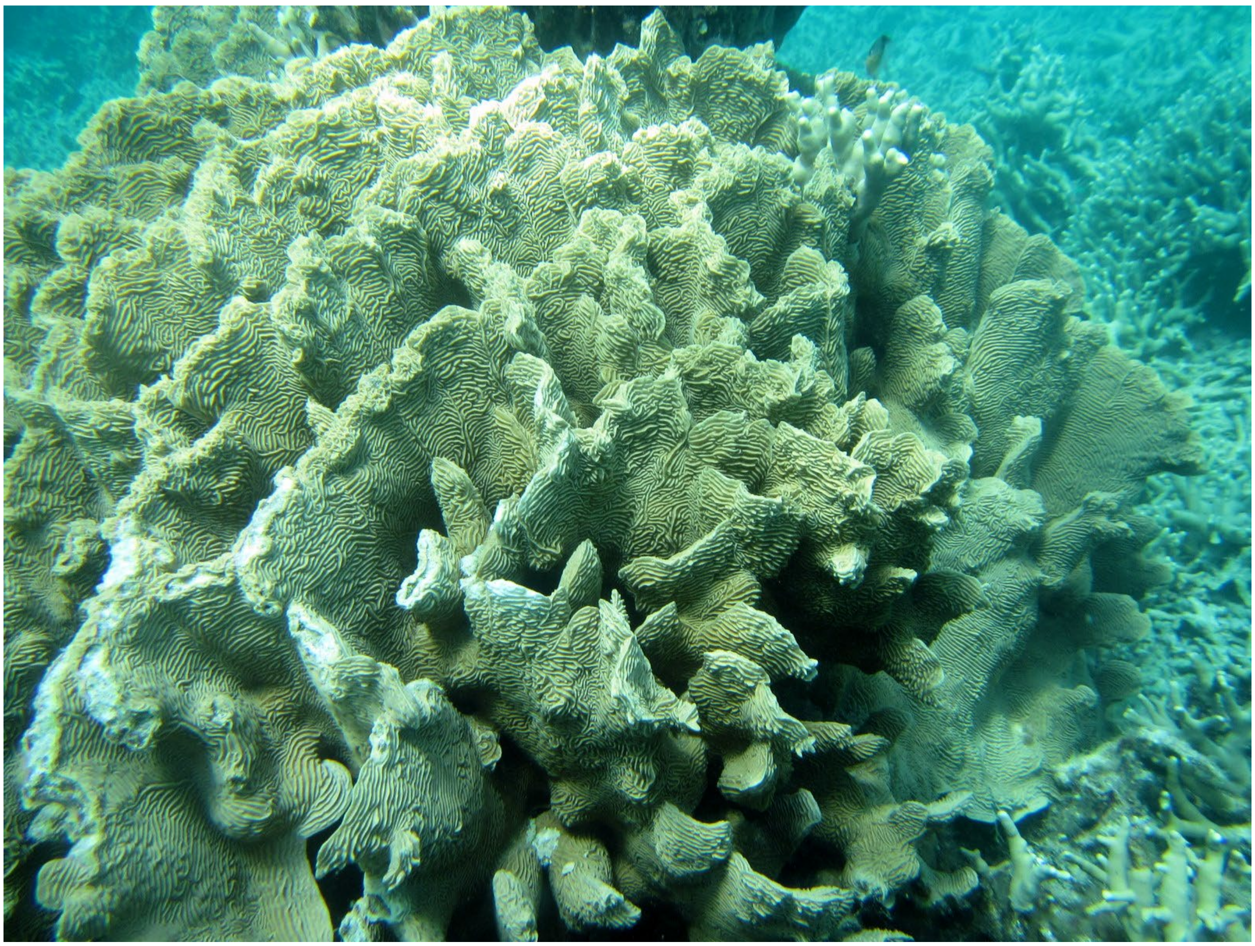

A close-up of *Pavona varians* showing the septa on the sides of the ridges.

Pachyseris

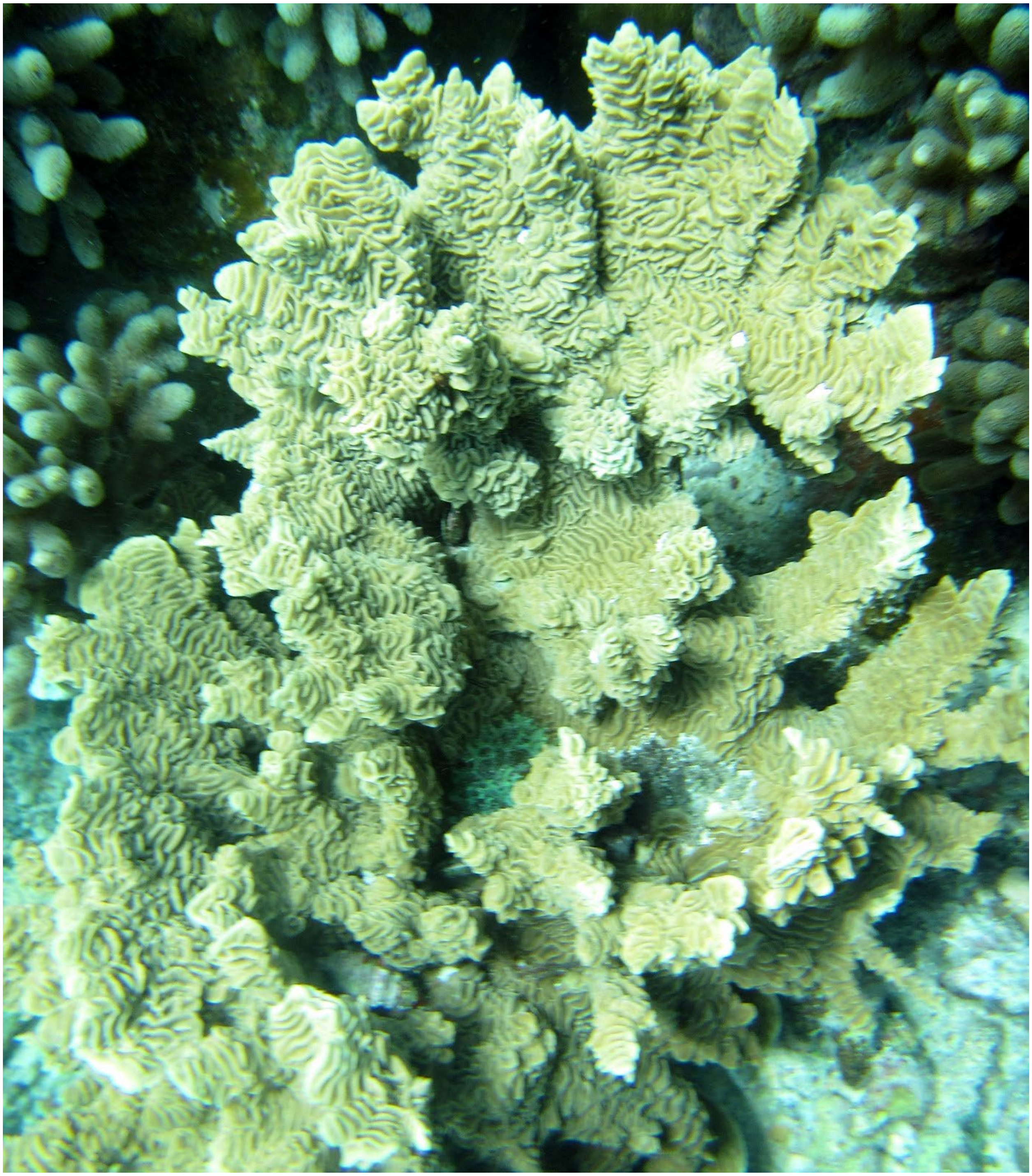
This genus forms plates that have small sharp ridges which are usually concentric on them. *Montipora* can have ridges on plates but the ridges are radiating, and smaller and less uniform.

Pachyseris rugosa Vulnerable EDGE

This species forms colonies with vertical paddles or plates that can range from thin to thick. Both sides of the paddles and plates are covered with small, sharp ridges. The ridges go lots of different directions and curve and wind around each other. Colonies are brown. This is the only *Pachyseris* species with ridges on both sides of the plates, and the only species with winding ridges.



A colony with large, intersecting plates.

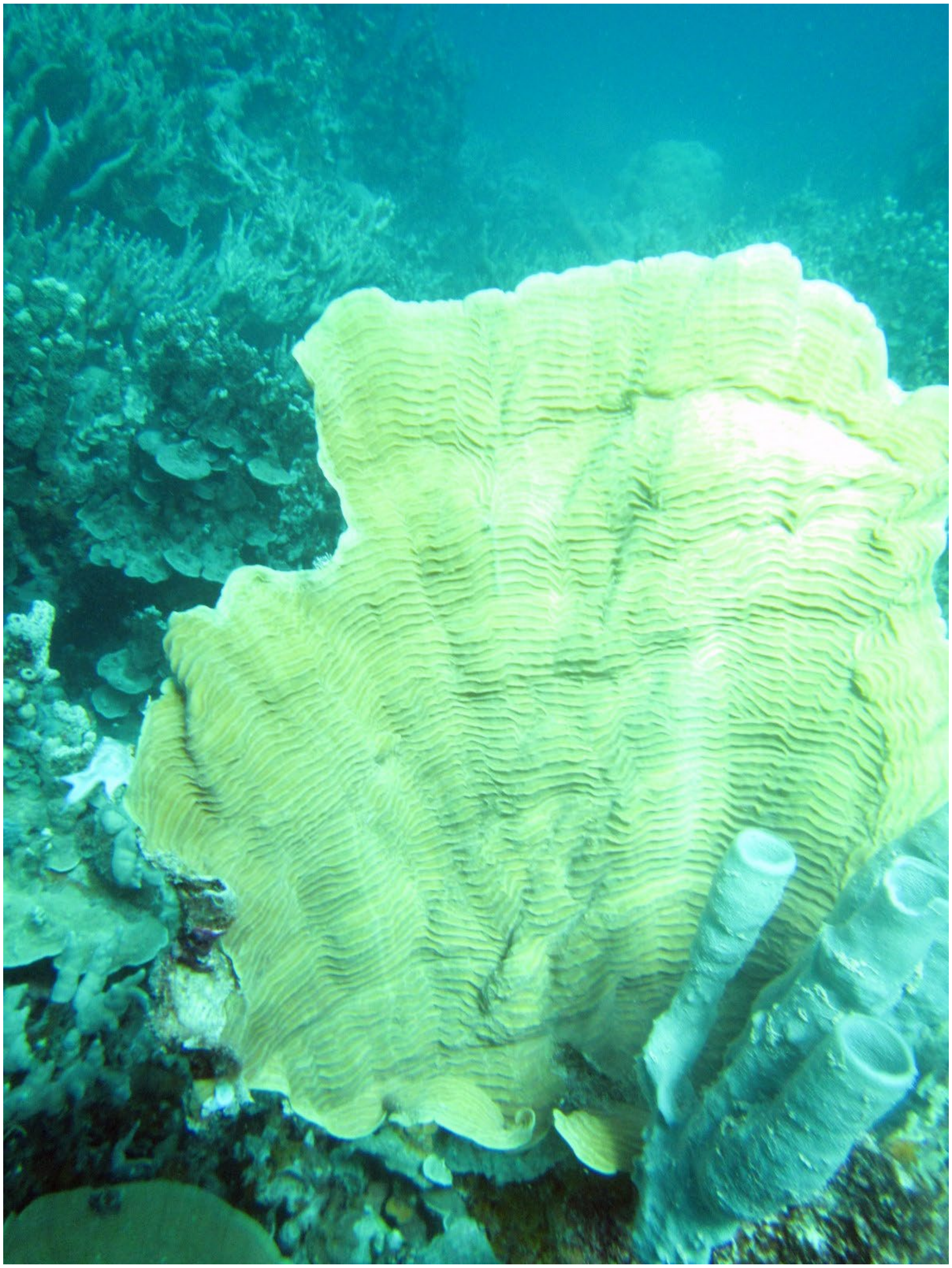


An irregular colony with smaller paddles and lumps.

A close-up photo of *Pachyseris rugosa*, showing the winding sharp ridges. Tiny lines on the sides of the ridges are the septa.

Pachyseris foliosa

This species forms plates that are large fronds growing upward at an angle, it usually does not form complete whorls. The ridges are concentric but widely spaced with flat space between them. Polyps are on only one side unlike on *Pachyseris rugosa* and the ridges are concentric and parallel.



A colony of *Pachyseris foliosa*.

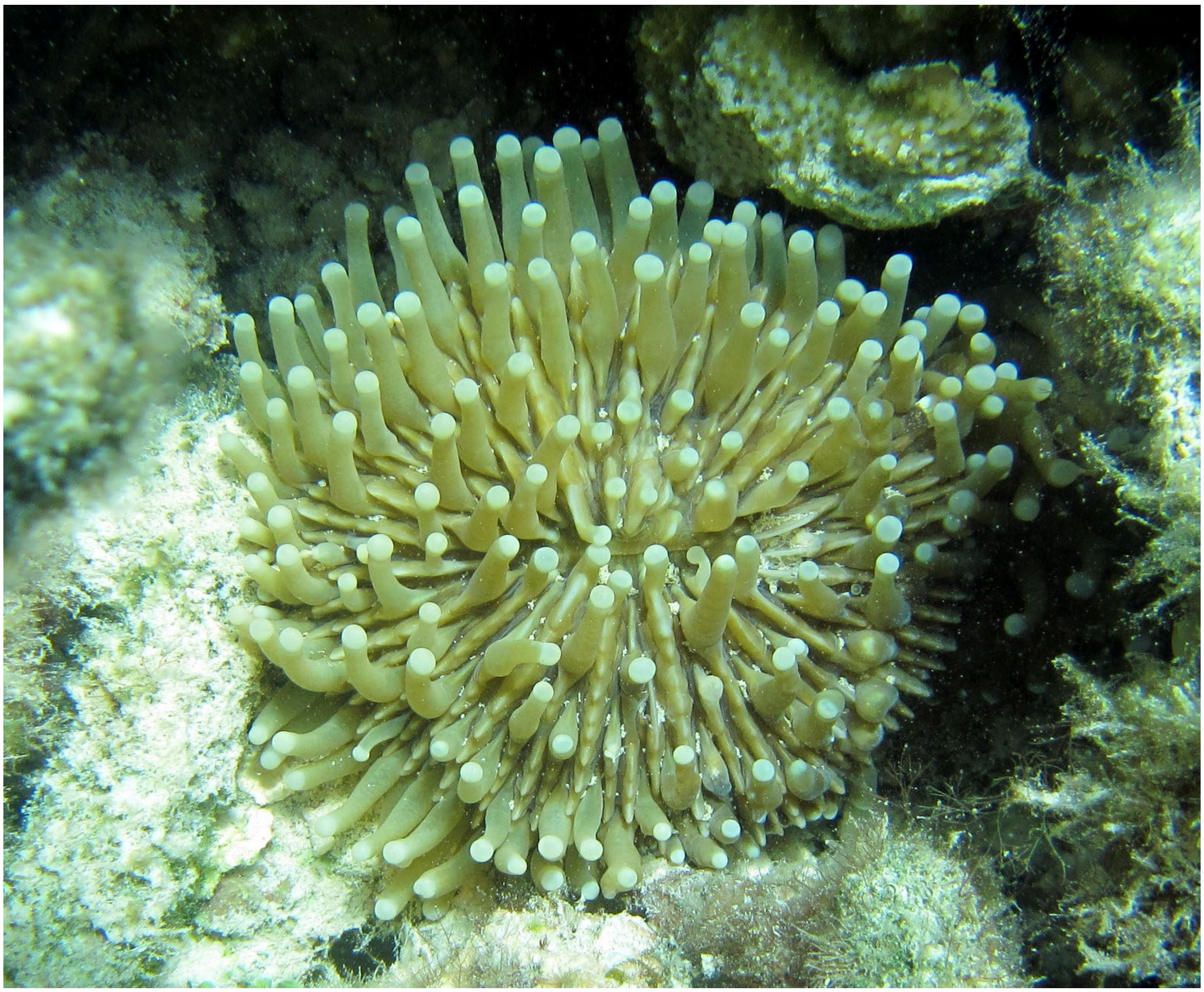
A close-up photo of *Pachyseris foliosa*, showing the concentric ridges and the wide, flat spaces between them.

Heliofungia “mushroom coral”

This genus forms mushroom corals that have large tentacles and can look much like an anemone. Each coral is a single large polyp. These corals do form a skeleton, which is disc shaped, but is not attached to the substrate. There is only one species in this genus. The tentacles are much larger than on any other mushroom coral, all other corals have smaller tentacles. Unlike an anemone it has a hard skeleton and is not attached.

Heliofungia actiniformis Vulnerable

This species forms mushroom corals with large tentacles. The skeleton has radiating ridges just like other mushroom corals, but the tentacles are far larger, and the skeleton differs in some details as well. No other mushroom coral has such large tentacles. These corals are usually less than 10 inches diameter.



A photo of *Heliofungia actiniformis*. Some of the radiating ridges (septa) can be seen between tentacles. Some may have even more tentacles that completely cover the ridges.

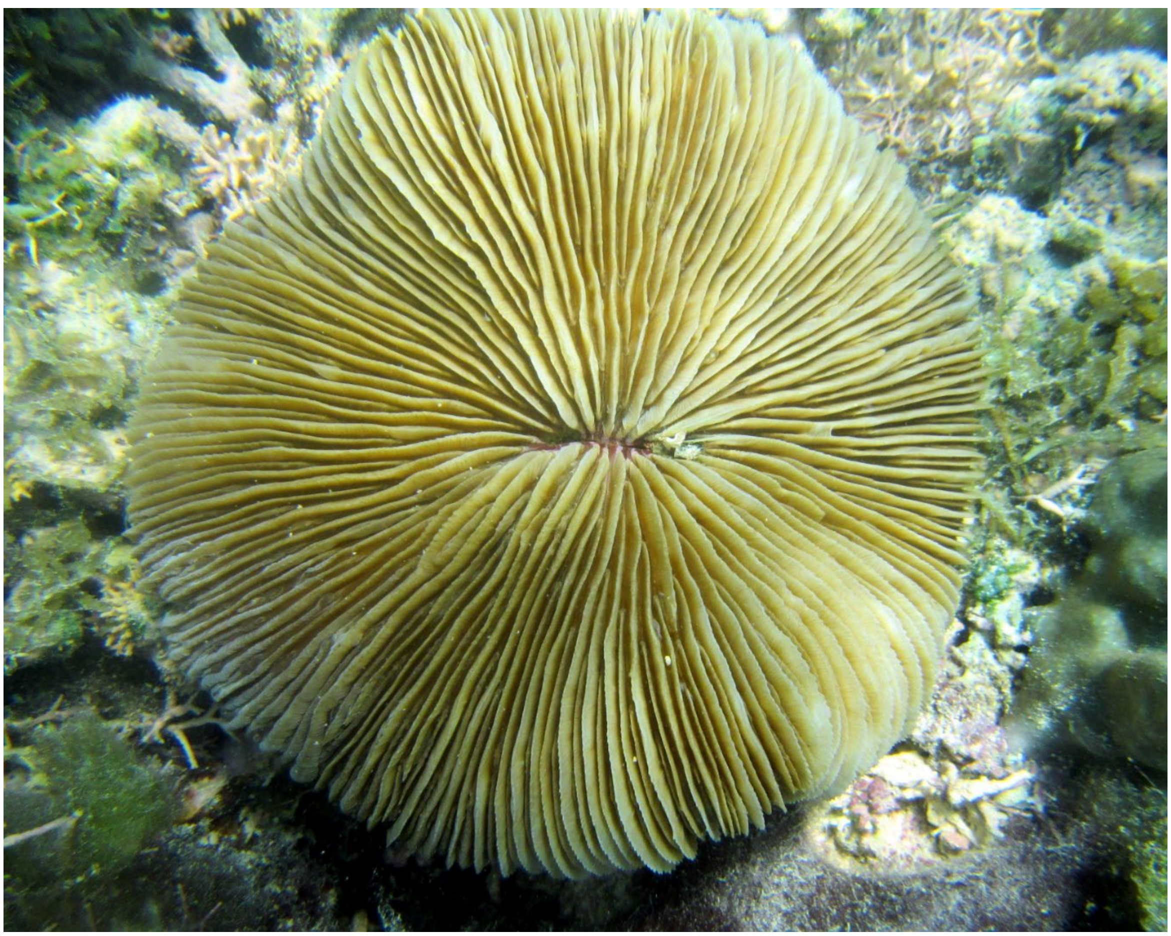
Lithophyllon "mushroom corals"

This genus forms corals that are either small attached plates with multiple mouths, or unattached discs that are single, solitary polyps and corallites. The unattached corals are often called "mushroom corals" because they look like the overturned cap of a mushroom. The upper side is where the polyp and inside of the corallite are. The slit in the middle is the mouth, and the radiating ridges are the septa. All corallites have septa, though in the smaller septa they are not visible underwater. The underside has radiating rows of spines, and corresponds to the outside of a corallite (polyp cup). You can easily pick these corals up.

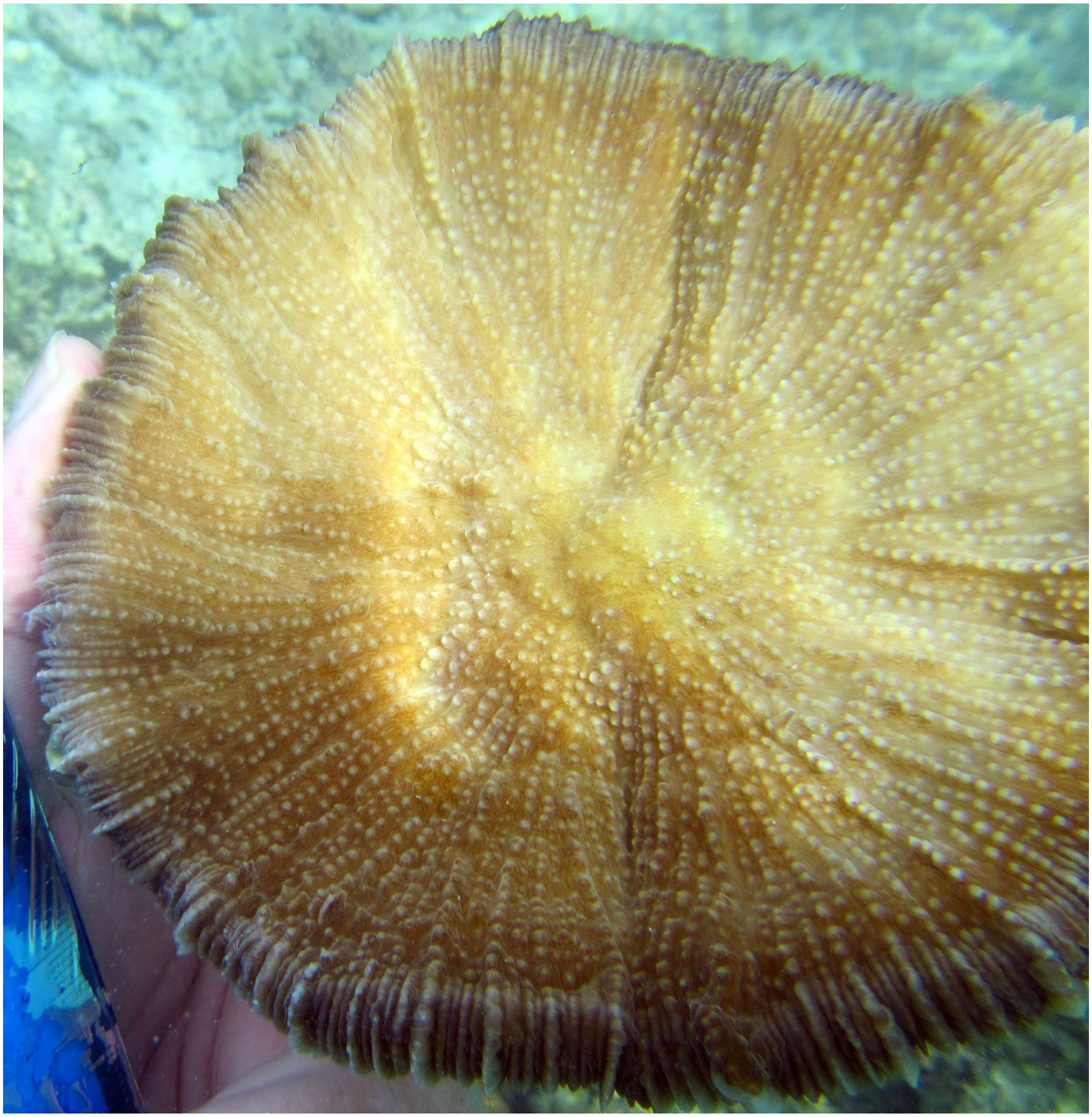
Lithophyllon concinna or Lithophyllon repanda

These were previously known as *Fungia concinna* and *Fungia repanda.*

This species forms discs up to about 8 inches diameter. The radiating septa have tiny teeth on them that can be felt if not seen. The underside has radiating rows of spines. These corals closely resemble *Fungia fungites*, but have smaller teeth on the septa, do not have extended tentacles, and do not have the same colors. *Pleuractis* and *Lobactis* have oval corals. *Lithophyllon concinna* and *Lithophyllon repanda* can only be distinguished by whether they have tiny slits on the underside, which cannot be seen in living corals with tissue.



The upper surface of a *Lithophyllon concinna* or *Lithophyllon repanda* coral.



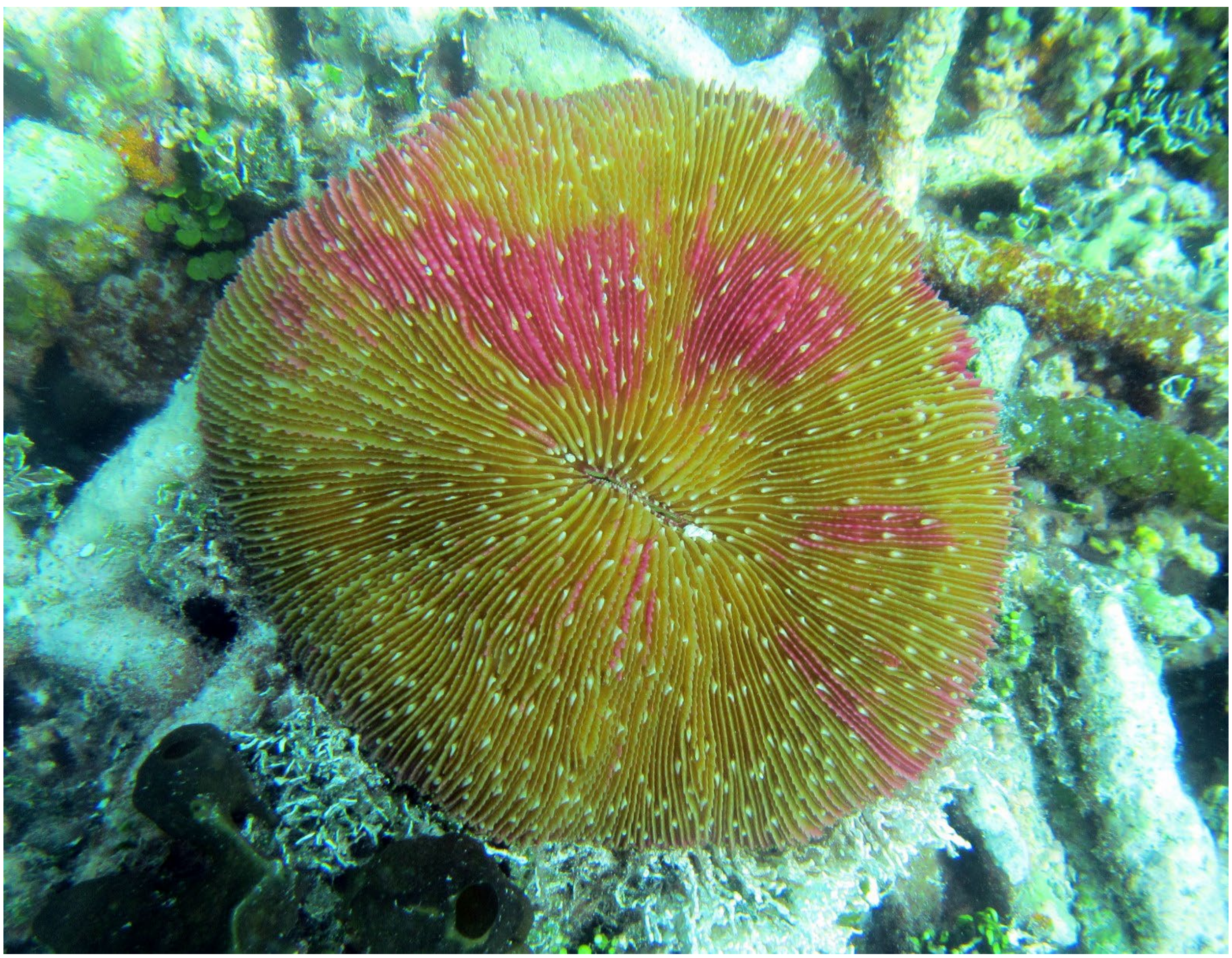
The undersurface of *Lithophyllon concinna* or *Lithophyllon repanda*.

Fungia "mushroom corals"

This genus forms corals that are unattached discs that are single, solitary polyps and corallites. They are often called "mushroom corals" because they look like the overturned cap of a mushroom. The upper side is where the polyp and inside of the corallite are. The slit in the middle is the mouth, and the radiating ridges are the septa. All corallites have septa, though in the smaller septa they are not visible underwater. The underside has radiating rows of spines, and corresponds to the outside of a corallite (polyp cup). *Fungia* has the largest polyps of all corals, they can be up to 1 foot in diameter. You can easily pick these corals up.

Fungia fungites

This species produces disc shaped corals. Usually small tentacles are extended. The radiating ridges (septa) are small and close together with small but visible teeth. These corals can be yellow, green, or have purple or red edges, splotches, or even be all purple or red. *Lithophyllon concinna* or *Lithophyllon repanda* have smaller teeth on the septa, septa farther apart, do not have extended tentacles, and different coloration.



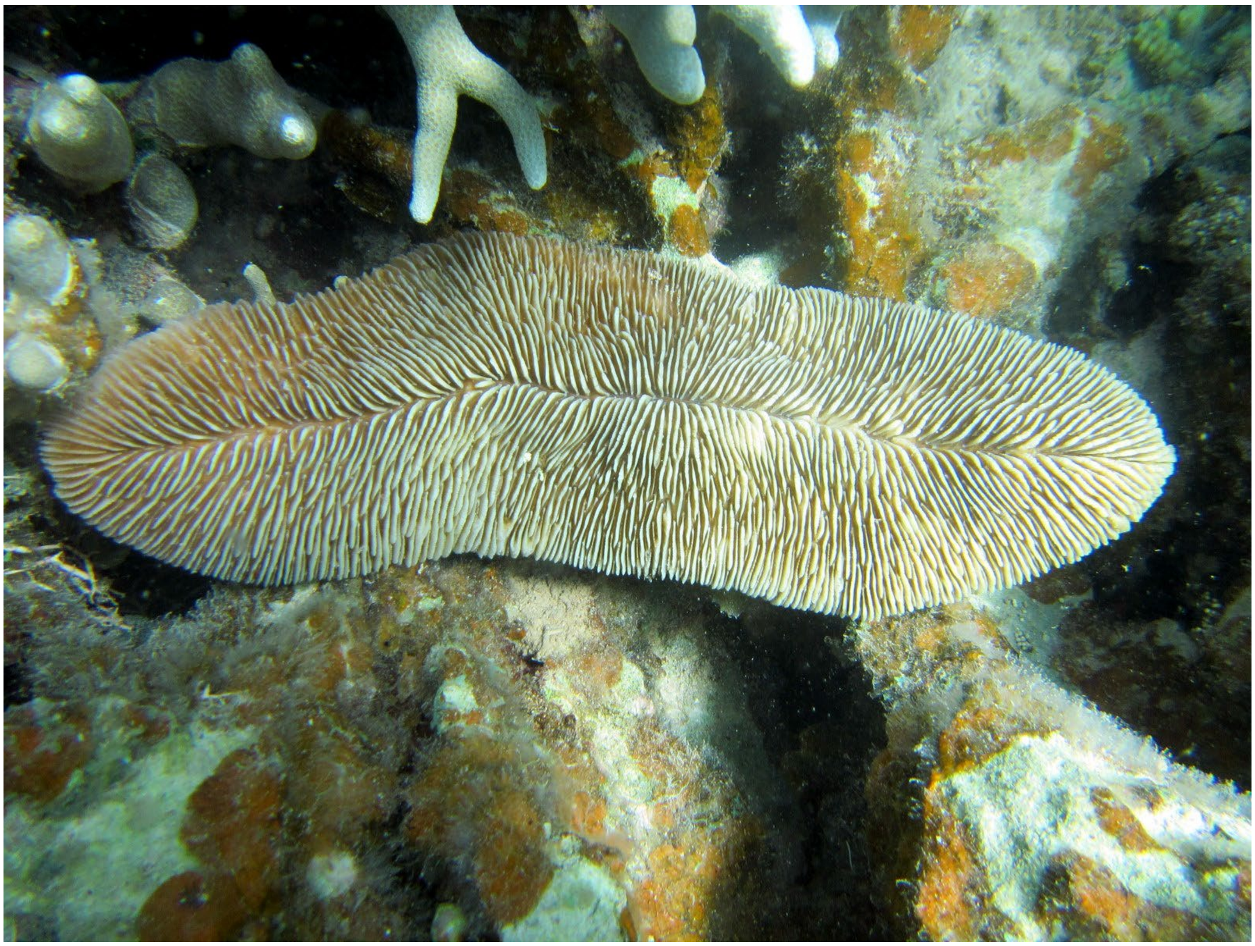
An example of *Fungia fungites*.

Herpolitha

This genus forms elongated, free-living colonies with a central crack that has multiple mouths, and the radiating septa have smooth edges. *Ctenactis* is a similar shape but has obvious teeth on the septa.

Herpolitha limax

This species forms elongated corals which are not attached (free-living). There is a central crack that goes most of the length of the coral and is divided into many sections, each of which is a mouth. Small ridges that radiate from the crack are the septa, and their edges are smooth. Septa only extend partway from the crack to the edge of the colony, and are replaced by other septa that also do not extend all the way. The top is often convex, and the bottom concave, though some colonies are fairly flat.



The upper surface of a colony of *Herpolitha limax*.

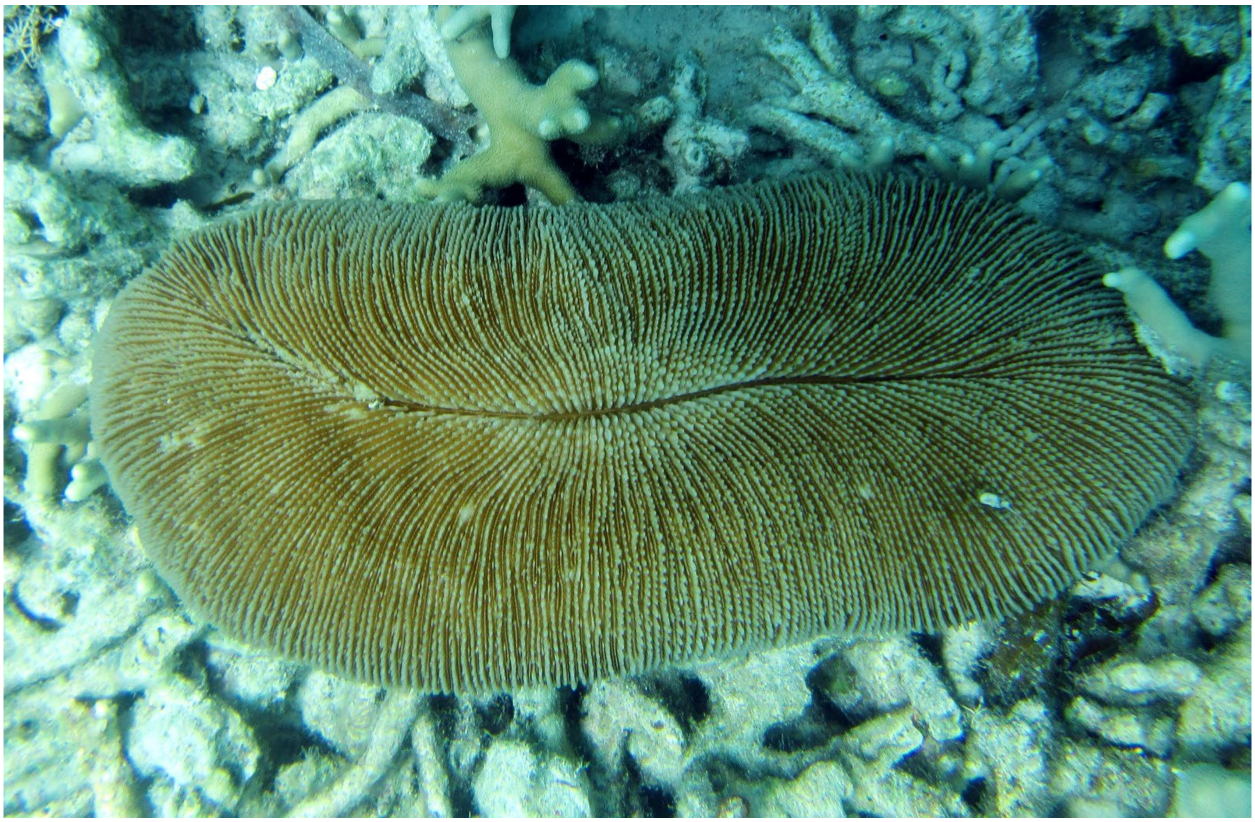
A photo of the underside of a colony of *Herpolitha limax*. The underside is concave and covered with tiny granules like sandpaper.

Ctenactis

This genus forms elongated corals with a long central crack where the mouths are, and radiating septa. The septa extend from the mouth to the edge of the colony and have teeth large enough to be seen.

Ctenactis echinata

This species forms oval, unattached corals with rounded ends. There is a single, uninterrupted crack running the length of the coral, which is the single mouth. So this is a single polyp. There are rows of radiating teeth or spines that radiate from the central crack. The teeth are on the edge of the radiating ridges, which are septa. The teeth are large and obvious, unlike in some other mushroom corals. The crack is continuous unlike on other species of *Ctenactis*, and there are no white tentacles.



An individual *Ctenactis echinata*. The teeth are visible on the radiating septa.

This is the underside of *Ctenactis echinata*. The underside is usually (but not always) concave and has radiating rows of short spines.

Ctenactis albitentaculata

This species forms colonies that have white tentacles. The septa are more widely spaced than on other species in the genus. This is the only species in the genus that has white tentacles.

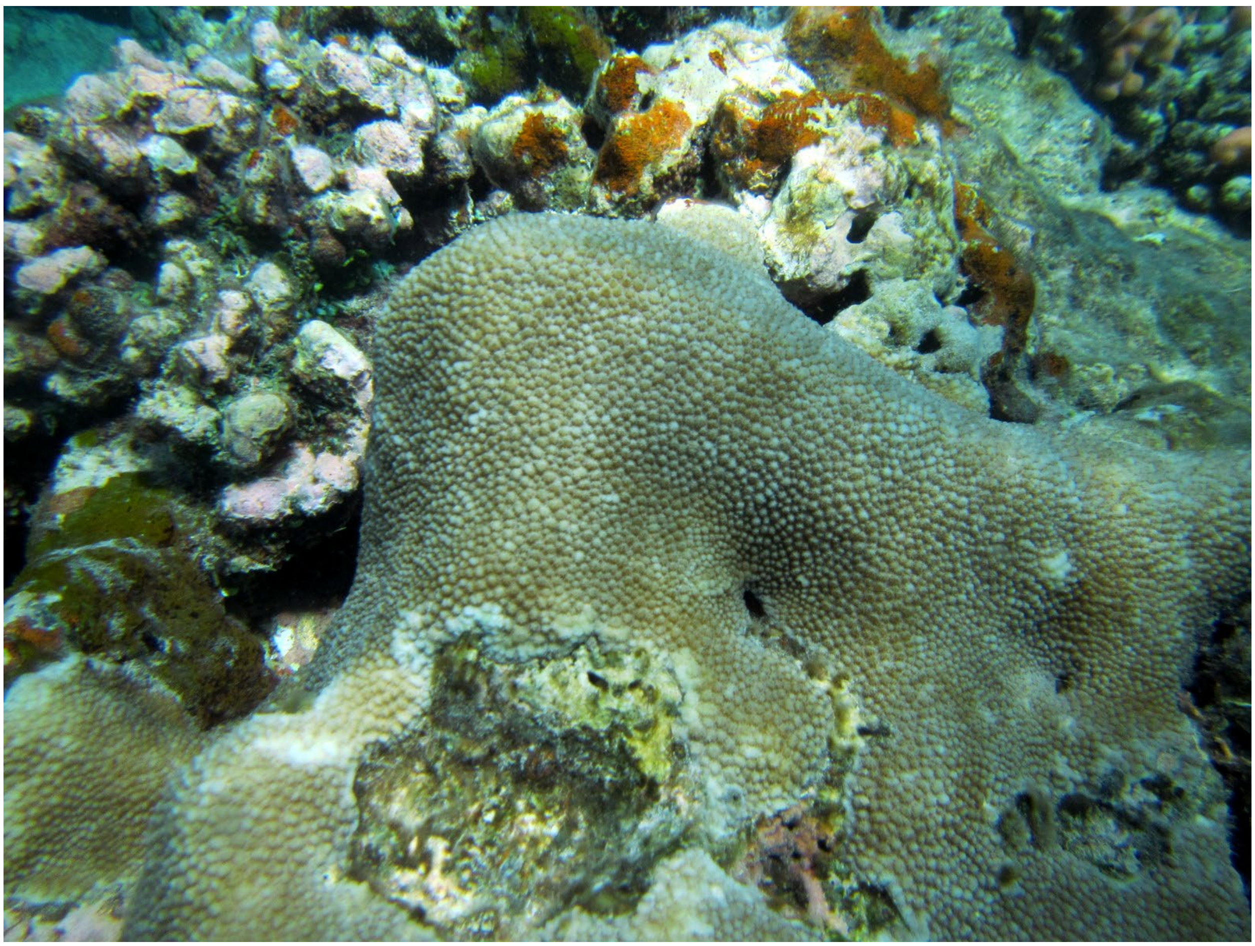
A photo of a colony of *Ctenactis albitentaculata*. The teeth on the septa are large enough to be visible, and the tentacles are white.

Hydnophora

This genus forms massive, encrusting, or branching colonies. All colonies have bumps or ridges on them, called "hydnophores." These bumps are between the corallites, so the polyps and corallites are in the valleys between the bumps. Also, septa run up the sides of the bumps. The bumps can range from tiny circular bumps to large elongated ridges. Other corals do not have hydnophores, their bumps do not have septa running up the sides of the bumps.

Hydnophora microconos

This species forms massive colonies that are covered with tiny circular or near-circular bumps. The bumps are about 2-4 mm diameter. The bumps are high and pointed and do not have corallites on them. There are tiny ridges running up and down the sides of the ridges, which are septa of corallites in between the branches. The tentacles are not extended on this species in the day. This is the only massive species of *Hydnophora*, and it has the smallest hydnophores of any species.

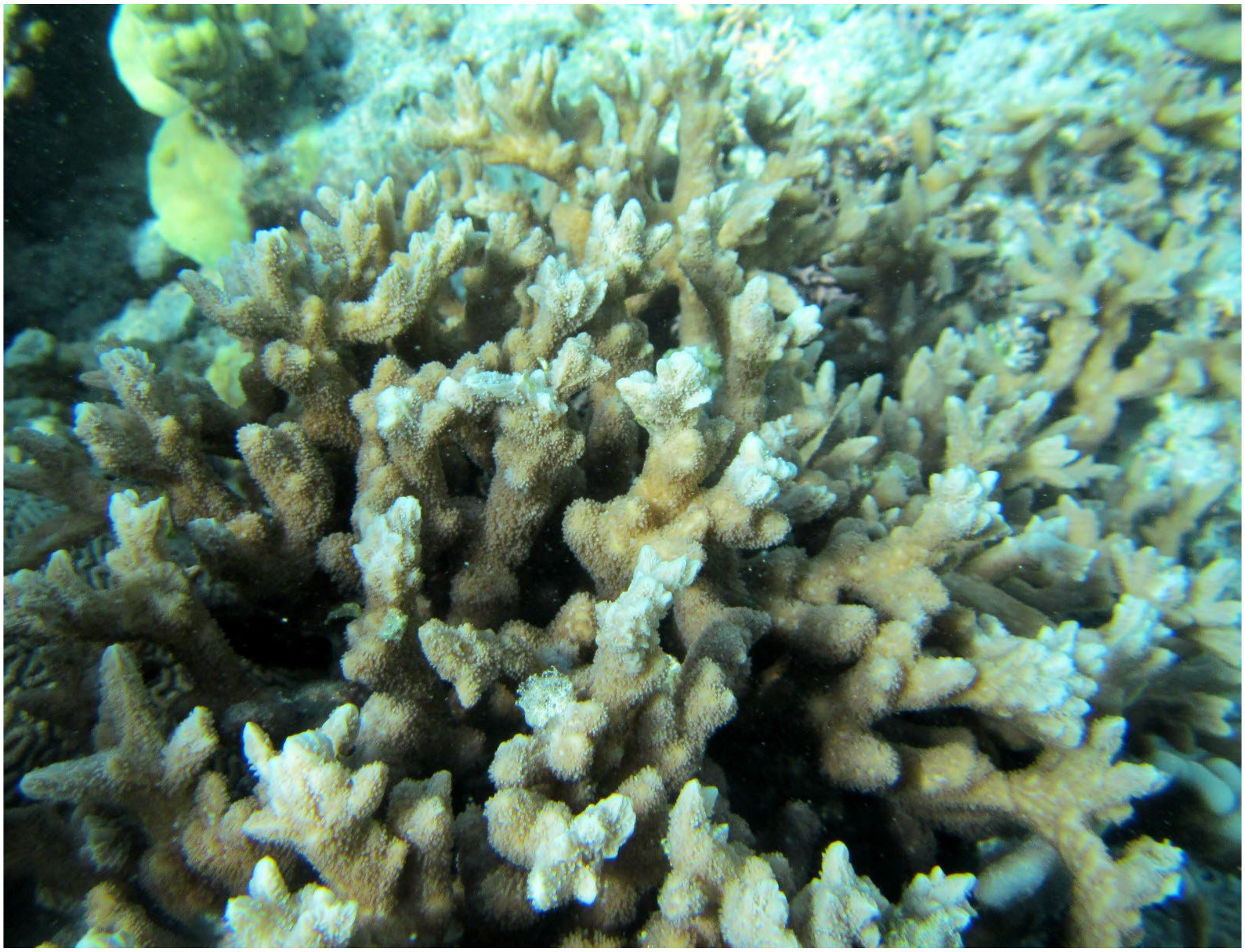


A colony of *Hydnophora microconos* covered with little bumps.

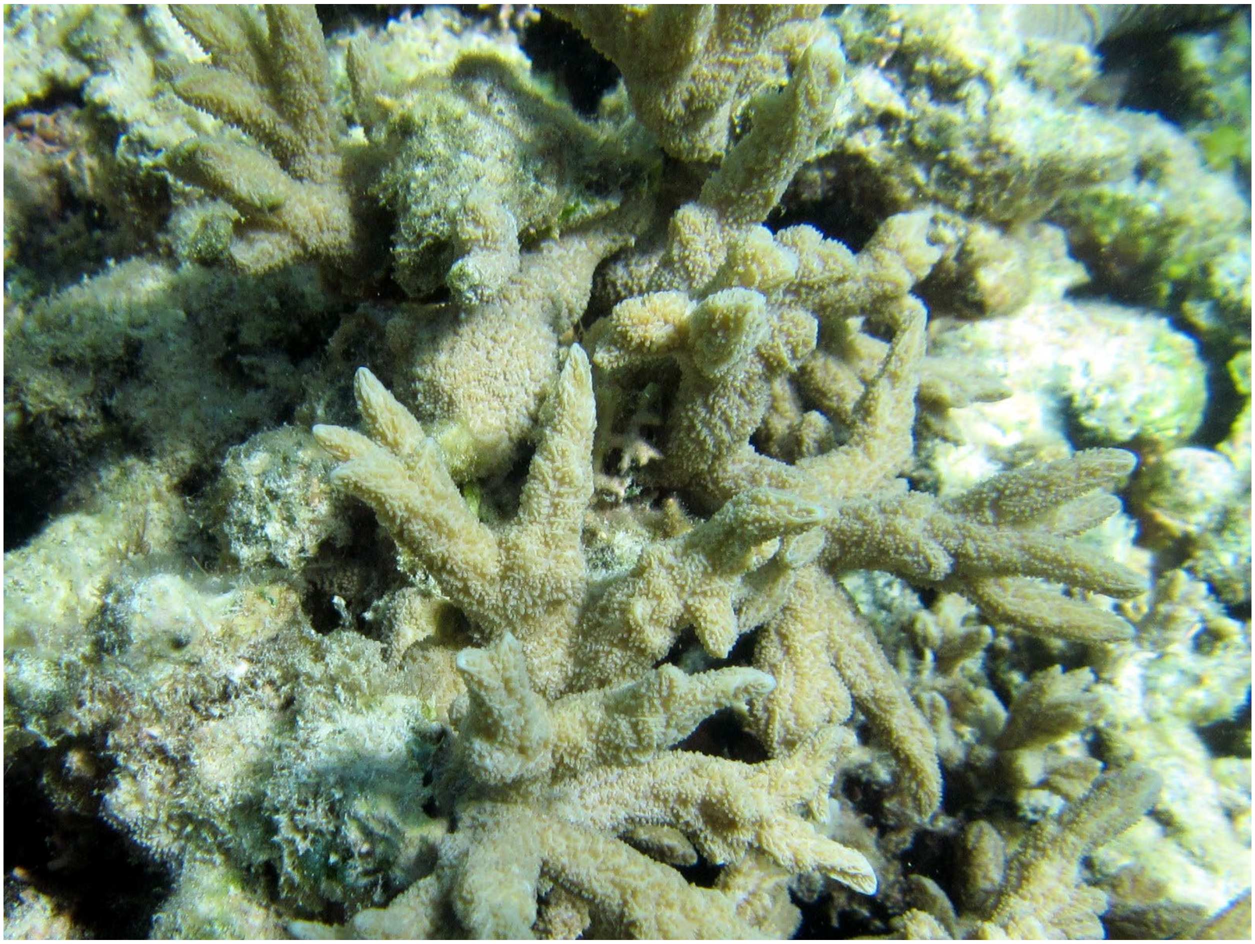
A close-up photo of *Hydnophora microconos*, showing the little bumps with septa on the sides.

Hydnophora rigida

This species forms branching colonies, with branches about the diameter of a small finger. The branches have oval to elongated bumps on them, which are usually elongated near the branch tip. Except at the branch tip, tentacles usually cover the bumps and ridges. There is no polyp or corallite on the end of a branch. *Hydnophora* cf. *grandis* sensu Veron, 2000 has thicker branches.



Colonies of *Hydnophora rigida*, showing the ridges, particularly near branch ends.



A close-up photo of *Hydnophora rigida*, showing the tentacles and ridges.

Pectinia

This genus forms small plates with spires or twisted paddles around the edge, or colonies of twisted paddles, or branching colonies with smooth branches. Corallites are not raised but can have good size centers compared to the rest of the colony.

Pectinia alcicornis

This species forms colonies with many twisted paddles and spires with a few corallites on them. Most other *Pectinia* species have taller, more rounded spires with several corallites on them. *Pectinia paeonia* has smaller polyp centers.

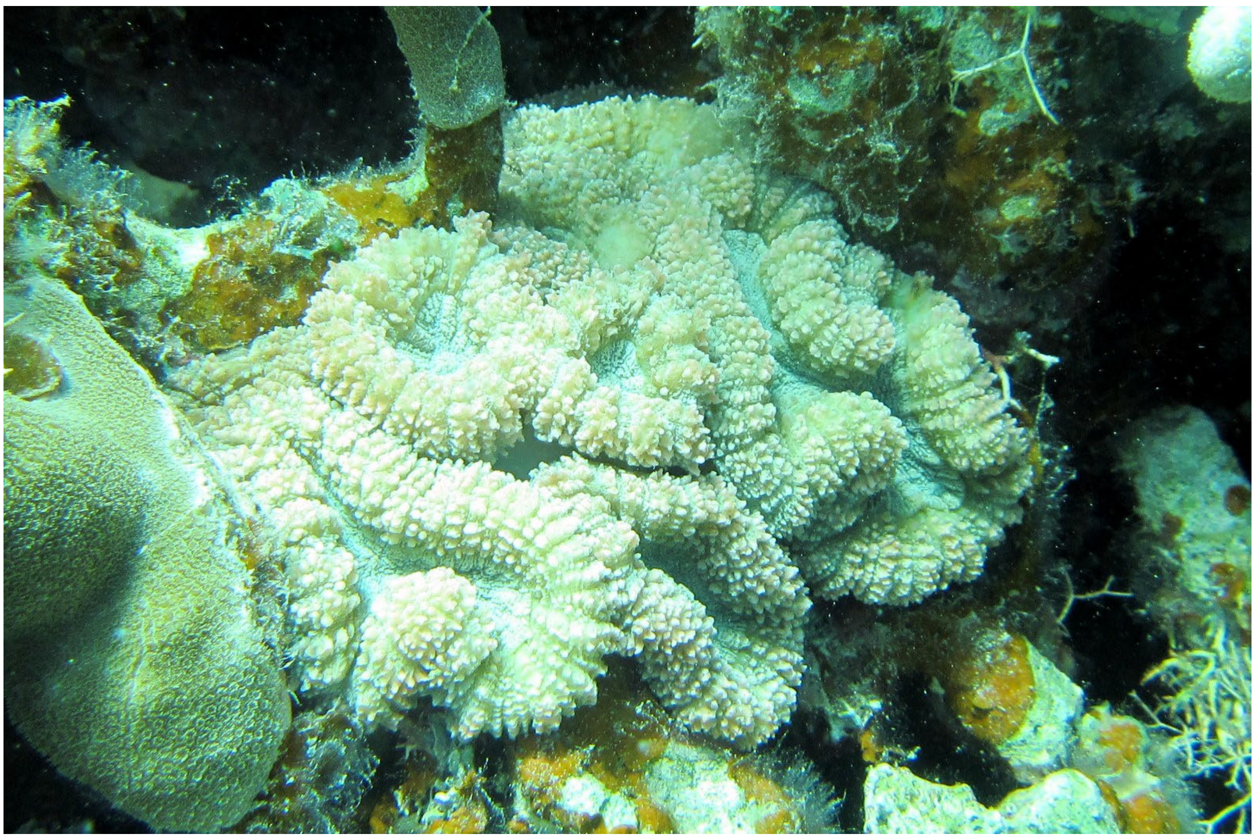
A colony of *Pectinia alcicornis*. The corallite centers are the same color as the colony on this colony, and so can’t be seen.

Lobophyllia

This genus forms colonies that can look like they are solid, massive colonies. However, they are actually branching with polyps only on the ends of branches, and narrow but deep cracks between the branches. The branches can only be seen in broken colonies. Colonies are called "submassive." Small, young colonies are encrusting. Some colonies that are massive with ridges on them were called "*Symphyllia*" but genetics shows they are in *Lobophyllia*.

Lobophyllia hemprichii

Colonies have very large polyps (and corallites), about 2-4 inches across. The polyps have a raised, rounded outer edge, and a lower, flat center. Some polyps may be circular in outline, but often they are oval or have a multiple lobe outline. The outer raised ring may have a rough or smooth surface. Other species of *Lobophyllia* have larger or smaller polyps. This is the most common species.



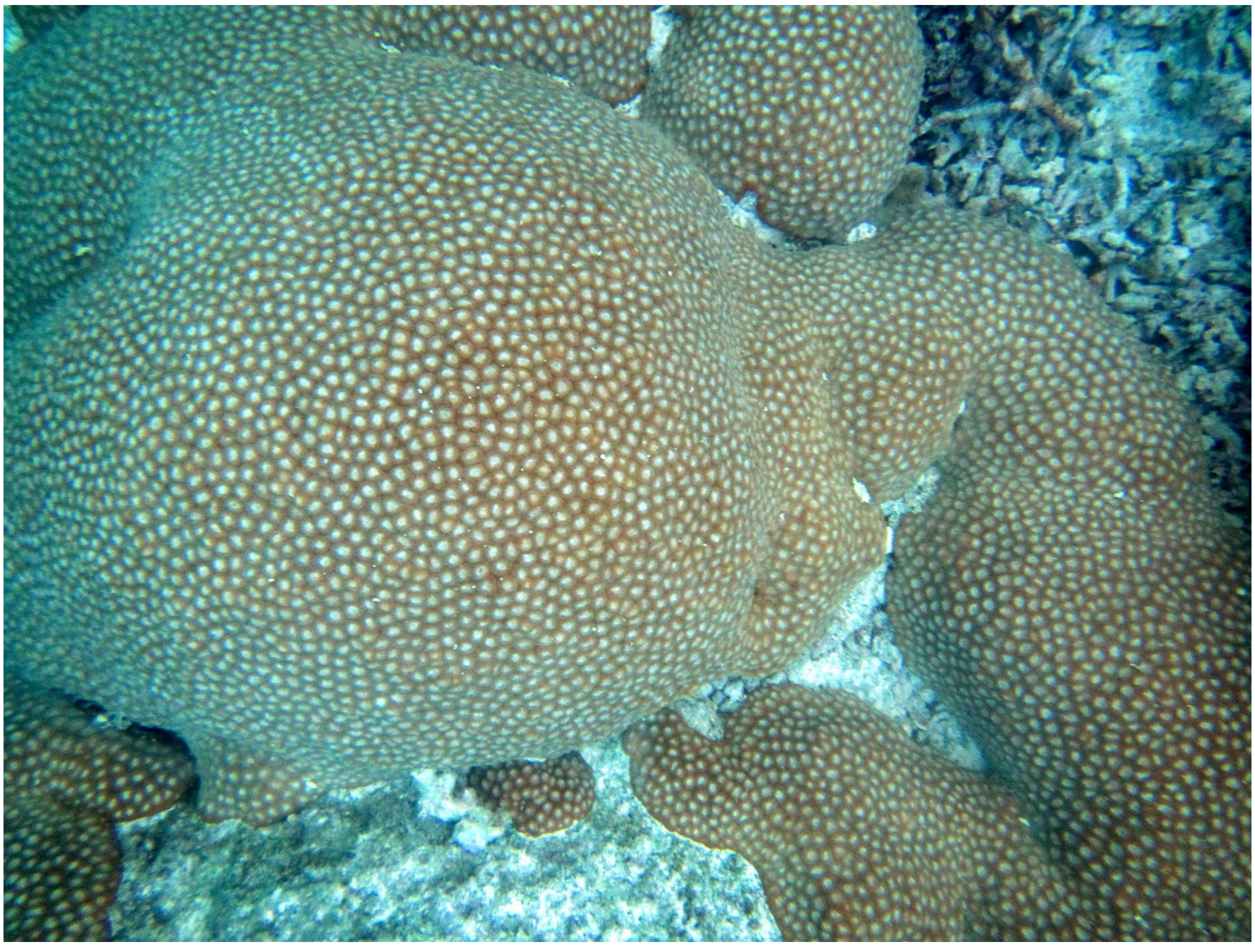
A small colony of *Lobophyllia hemprichii*. This colony is small with very short branches. Corallites are separated by deep cracks.

Diploastrea

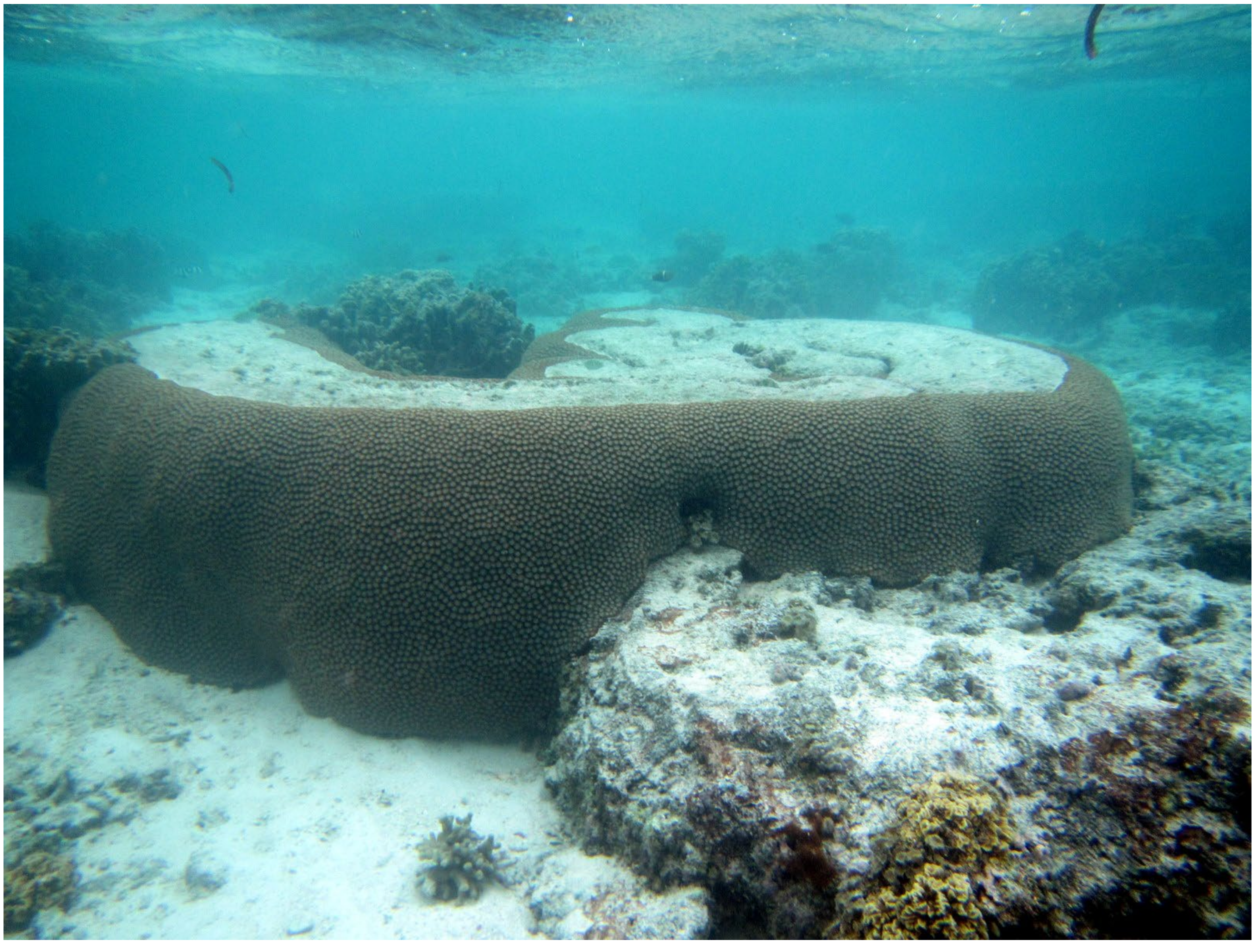
There is only one species in this genus, so the features of the genus are those of the species.

Diploastrea heliopora

This species produces large encrusting or massive colonies. The corallites are about the diameter of a finger, and are shaped like rounded cones or volcanoes. The center of the corallite is recessed and often white, and the outside of the corallite has radiating small ridges. Corallites are close together but do not share common walls. The tentacles are rarely extended. This is one of the most distinctive of all corals. *Dipsastrea* does not have tapering corallites like this species has.



A massive *Diploastrea heliopora* colony.



A colony on the reef flat. The dead top is due to low tides. This is called a “microatoll” since it will grow to have a rim higher than the dead center.

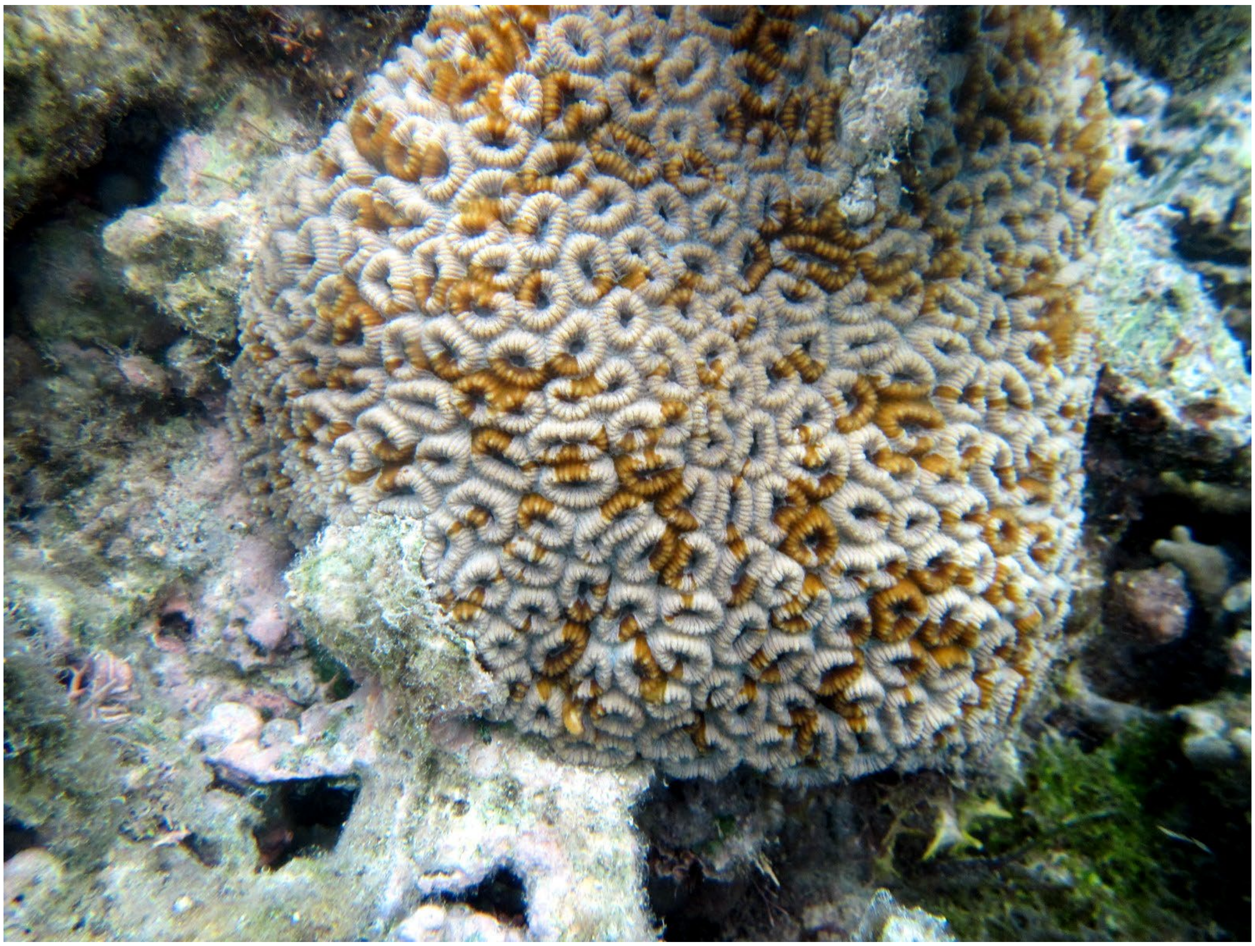
A close-up photo of *Diploastrea heliopora*.

Dipsastrea This used to be called *Favia*

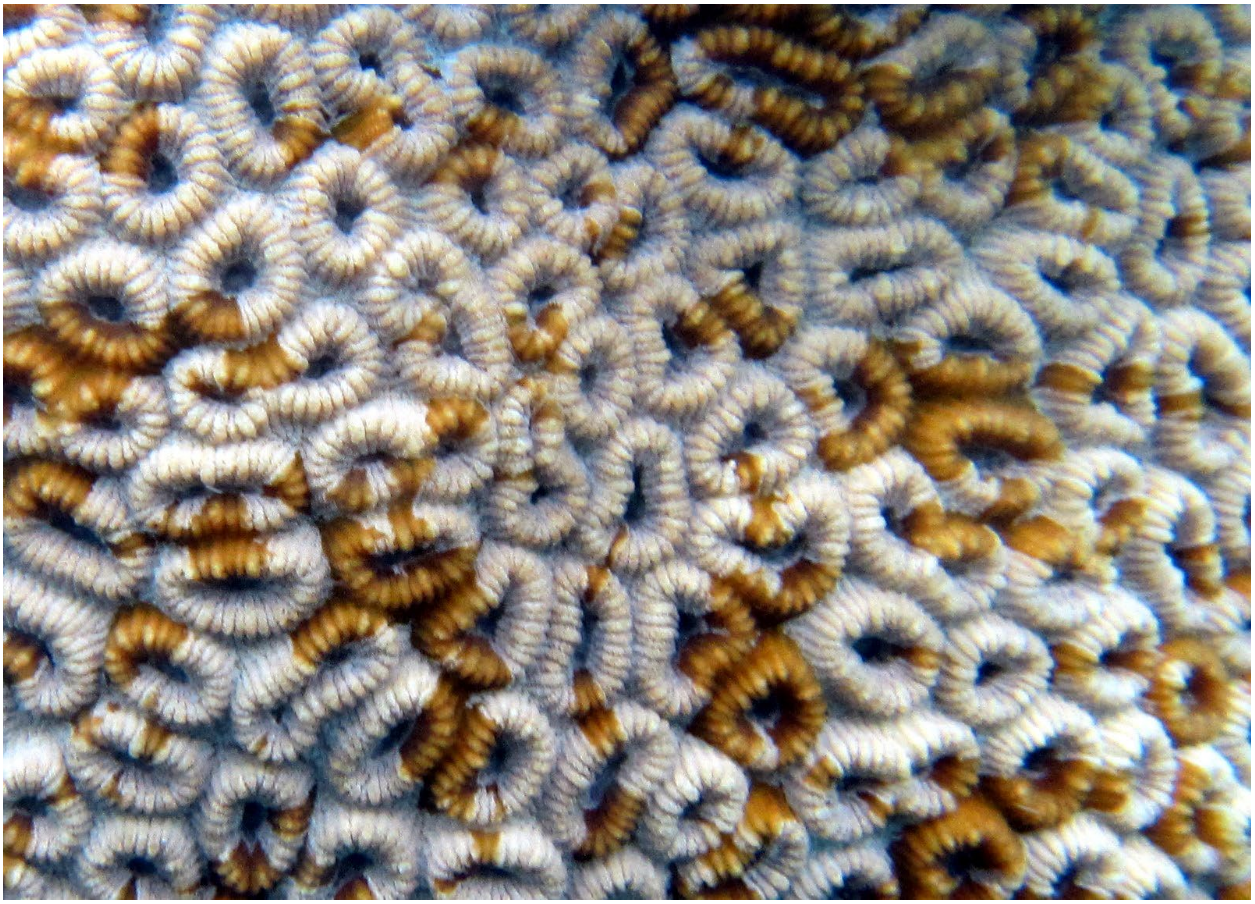
This genus forms massive or encrusting corals that have medium-sized corallites, about 4 mm to 1 inch diameter. The corallites project and have a crack or lower space between them, so that both an inside and outside to the corallite (cup) can be seen. *Favites* and *Goniastrea* do not have a crack or space between corallites, they share a common wall.

Dipsastrea sp. 1 This used to be called *Favia*.

This species forms colonies with clearly projecting corallites that have a crack or lower space between the corallites. The corallites have rounded walls and range from circular to oval to pinched. Sometimes there is a mottled color pattern on the colonies. The septa are small and uniform on this species.



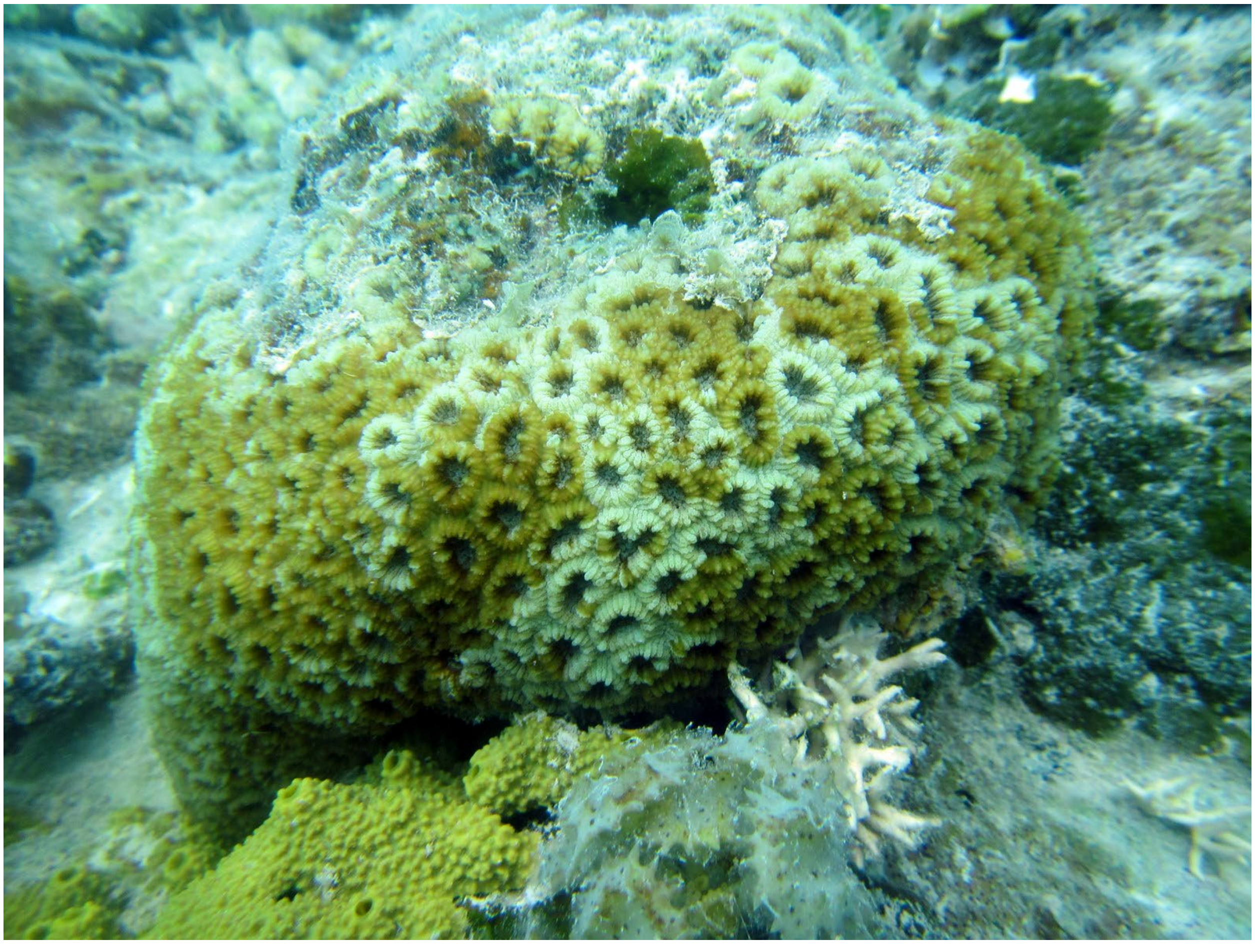
A colony of *Dipsastrea* sp. 1.



A close-up of *Dipsastrea* sp. 1.

Dipsastrea matthai

This species forms colonies with corallites that are quite close together but which are clearly separate. The septa are clearly visible and fairly thick on the top of the wall of the corallite. The septa are larger than on *Dipsastrea palida*.

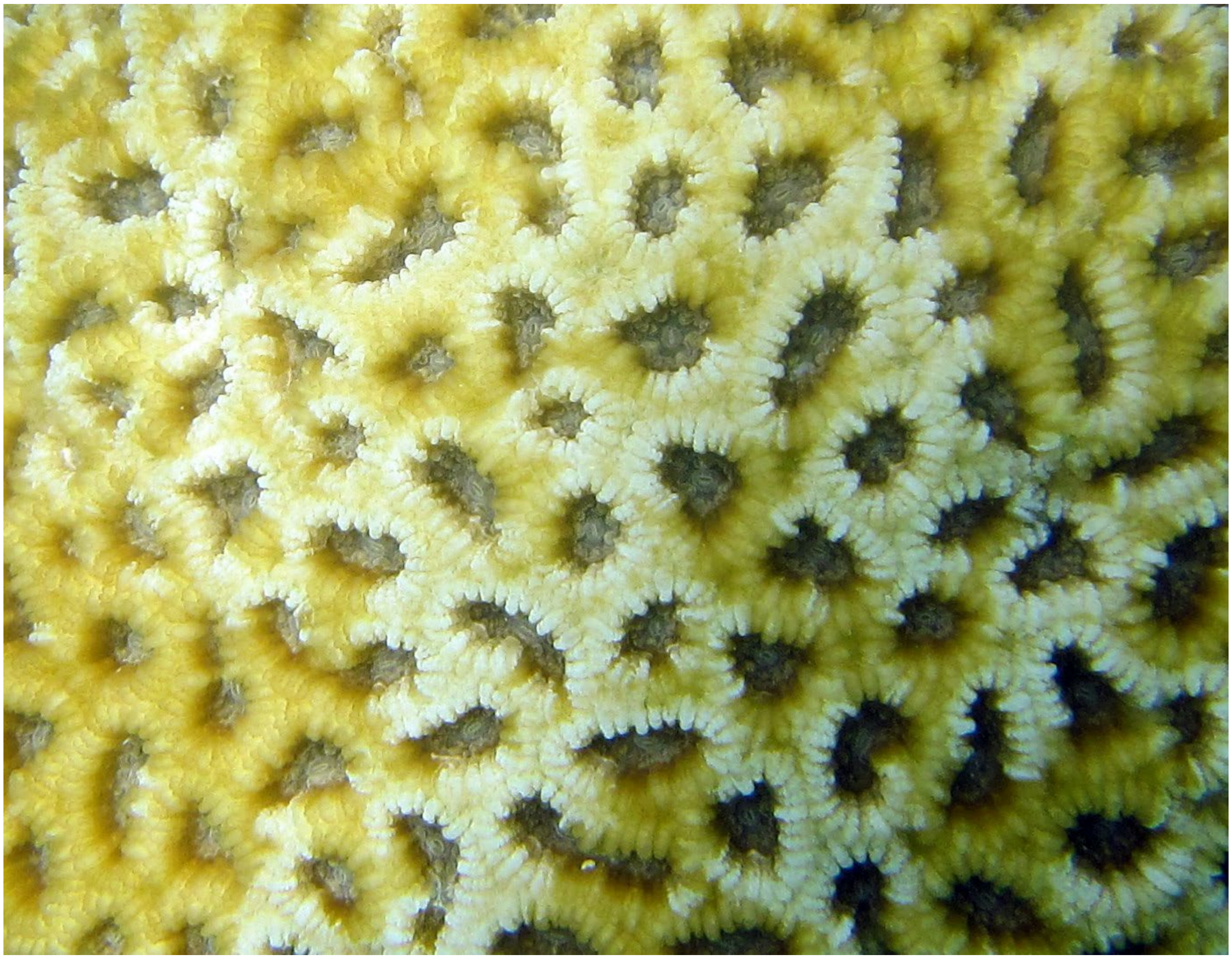


A colony of *Dipsastrea matthai*.

Dipsastrea pallida

This species forms massive colonies with corallites that are usually darker than the ridges between them. The corallites are separated by only a very tiny groove. Colonies are usually a shade of yellow. Corallites are less separated than on other *Dipsastrea*.

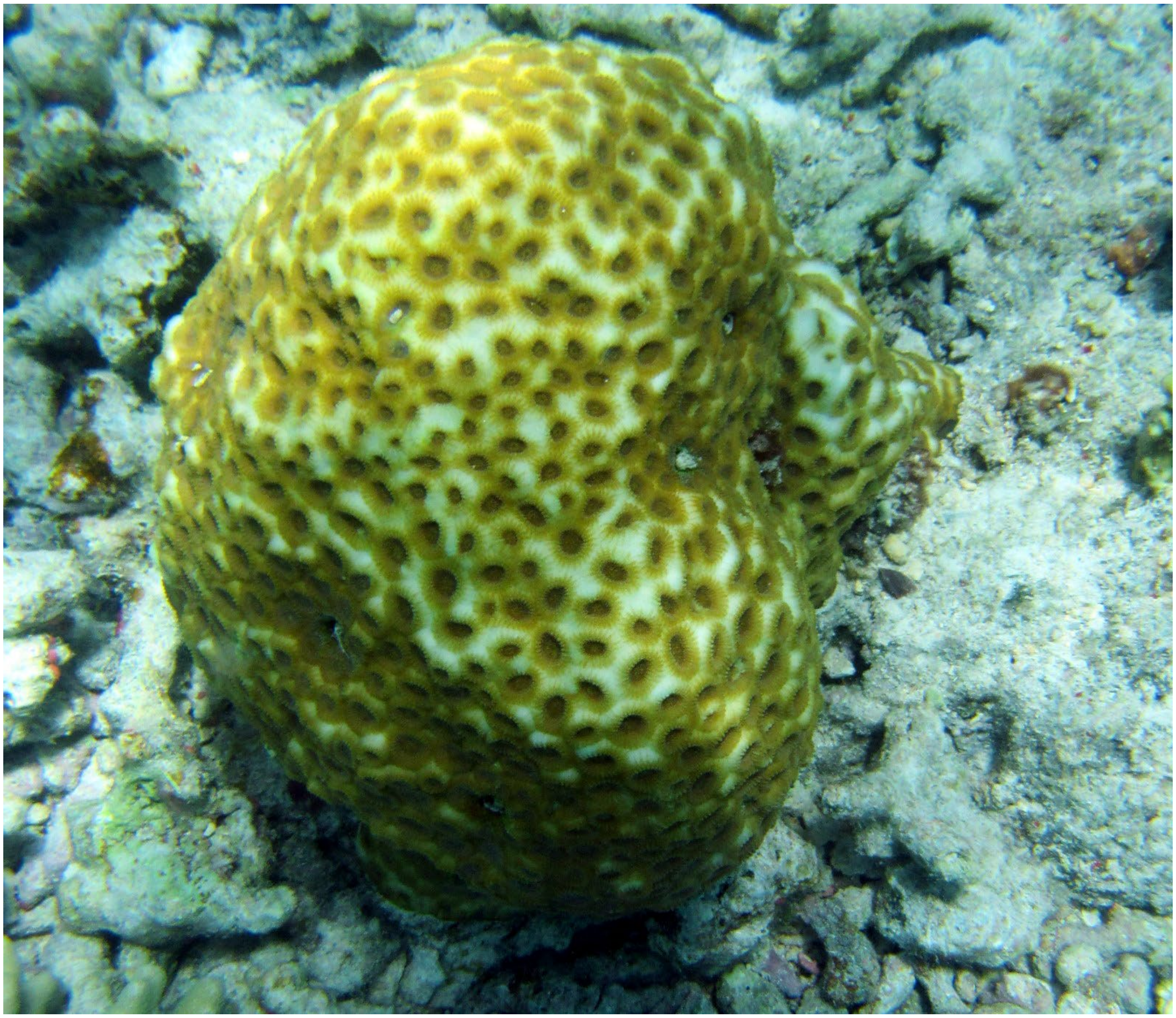
A colony of *Dipsastrea pallida*.



A close-up of *Dipsastrea pallida*, in which the septa can easily be seen.

Dipsastrea sp. 2

This species forms massive colonies with corallites about the diameter of a finger. In places the corallites may be separated by wide spaces, and in other places only by a thin line.

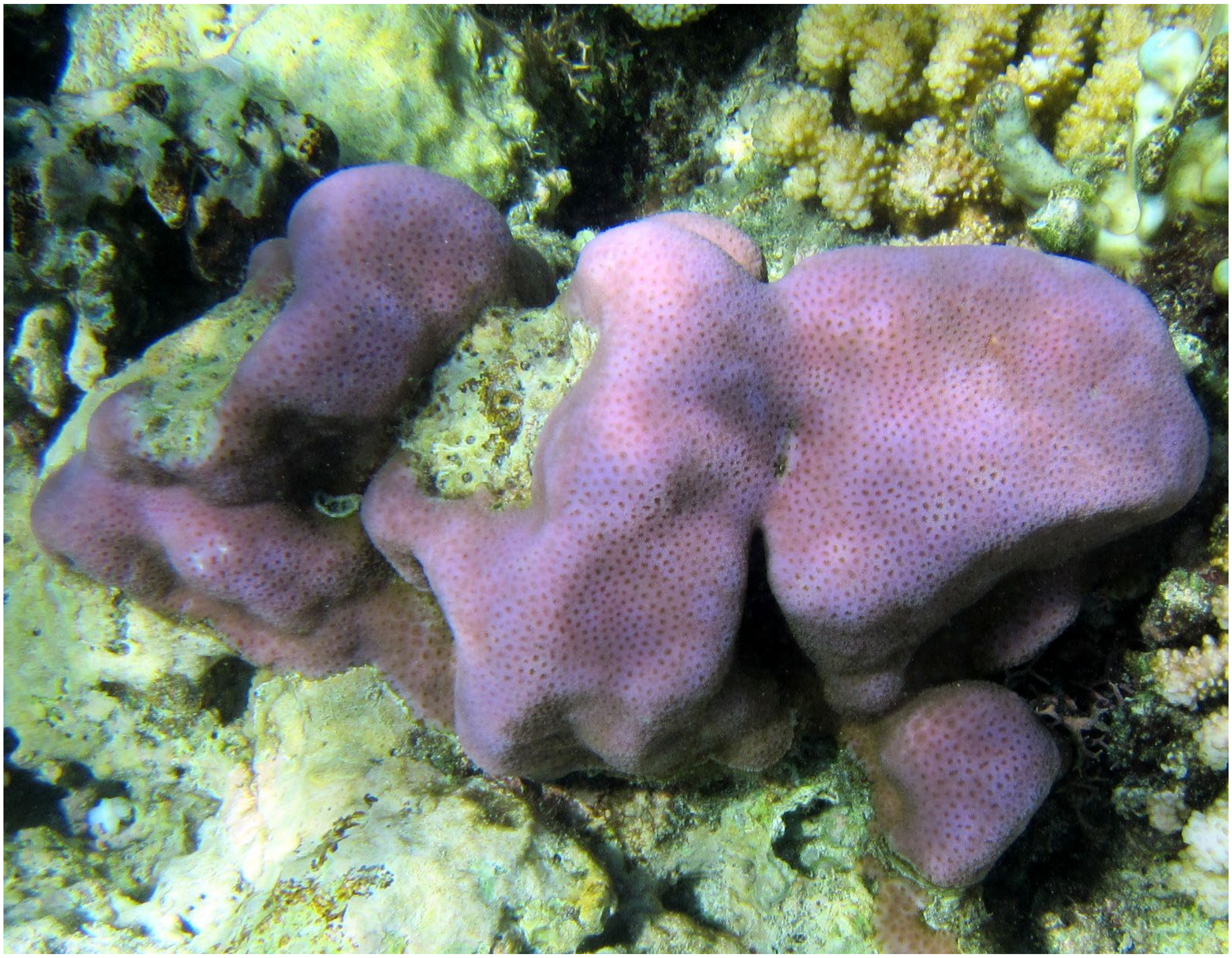


A photo of *Dipsastrea* sp. 2.

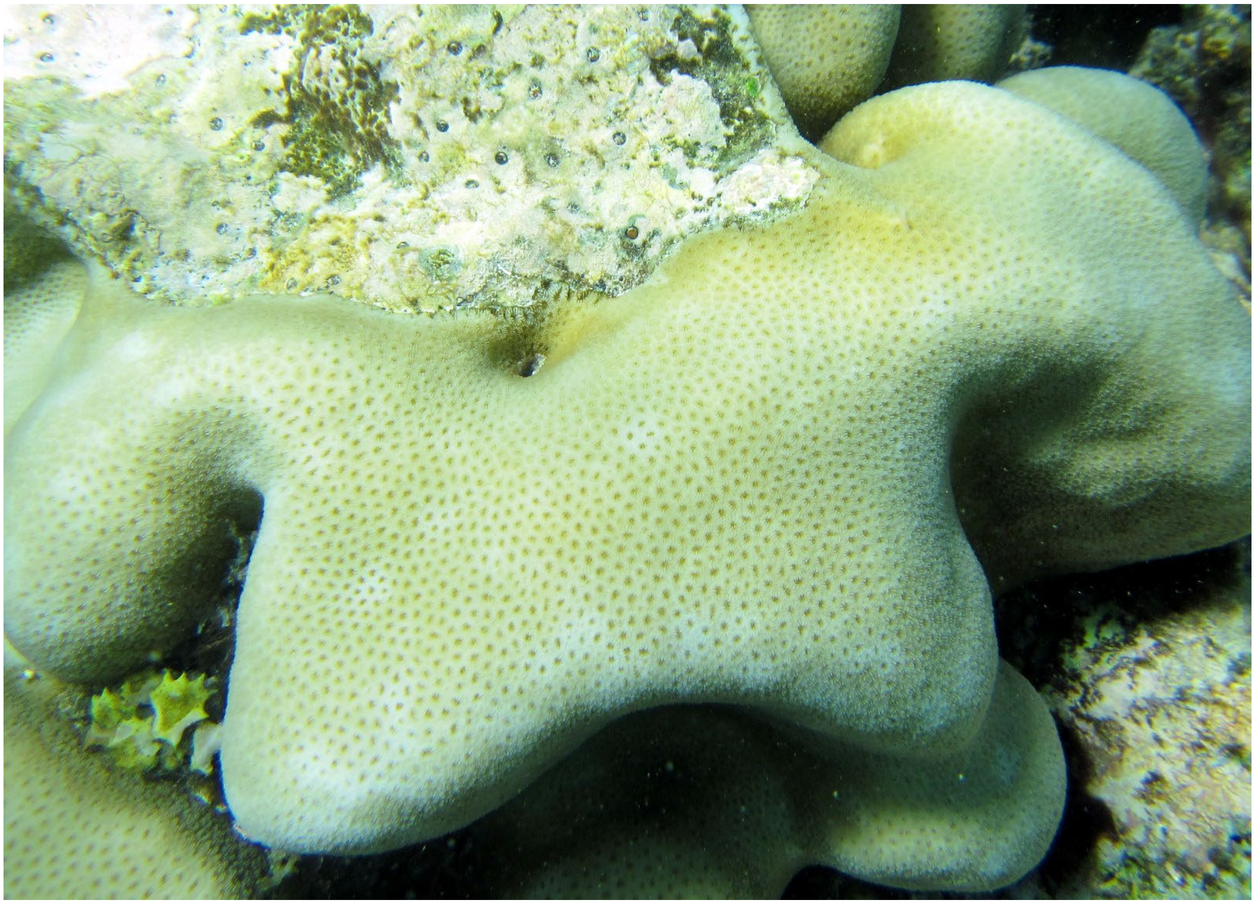
Goniastrea stelligera

This used to be called Favia stelligera.

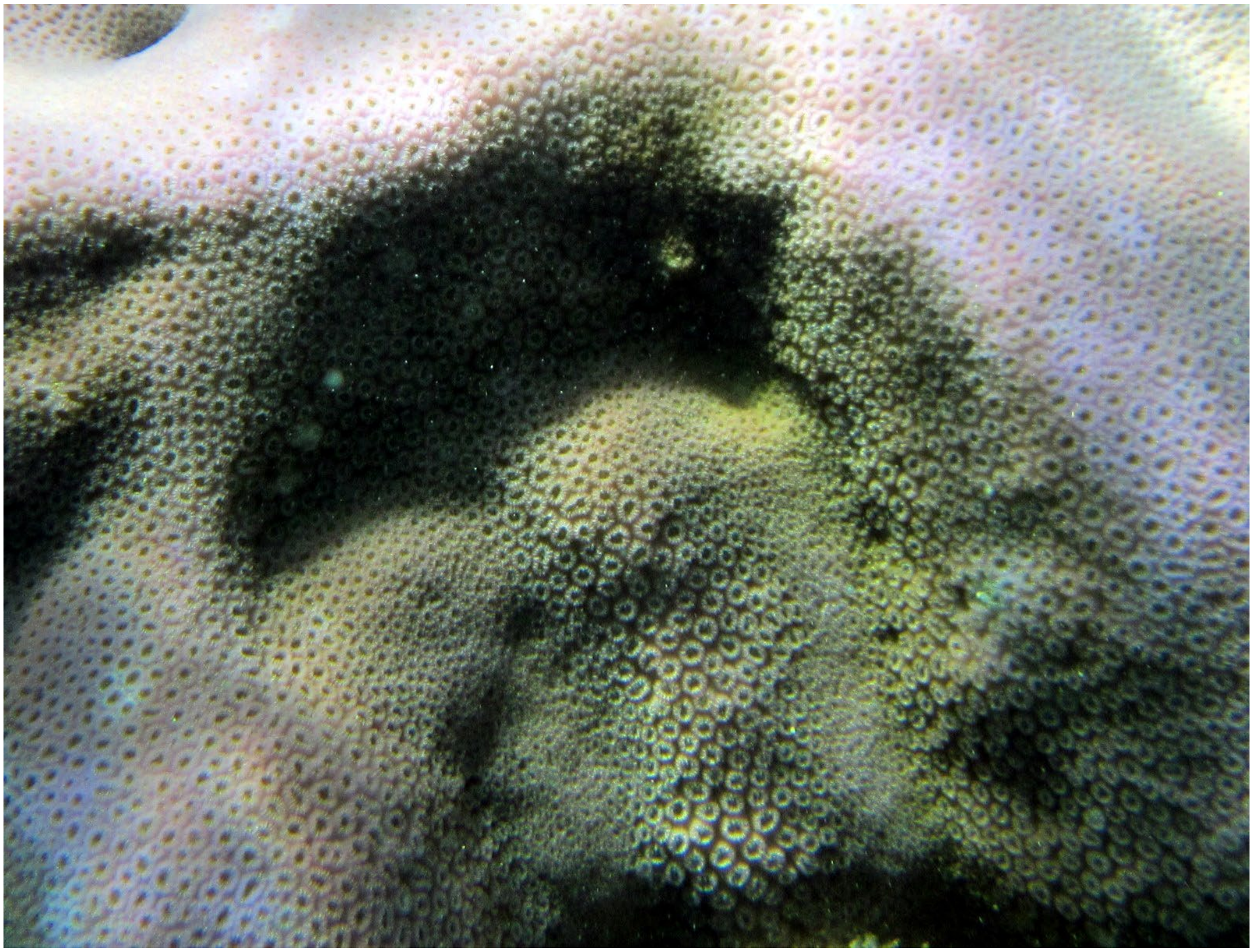
This species forms lumpy or columnar colonies with smallest corallites than any *Dipsastrea*, about 4-5 mm diameter. Sometimes the corallites are raised and there is an obvious crack between them, other times they are not raised much and only a tiny line separates corallites. Here they seem to be purple most often, but they can also be brown. Other species of *Goniastrea* do not have corallites separated by a crack.



A lobed colony of *Goniastrea stelligera*. It is possible that the purple color could be because the colony is bleached, but I'm not sure.



A brown colony of *Goniastrea stelligera*.



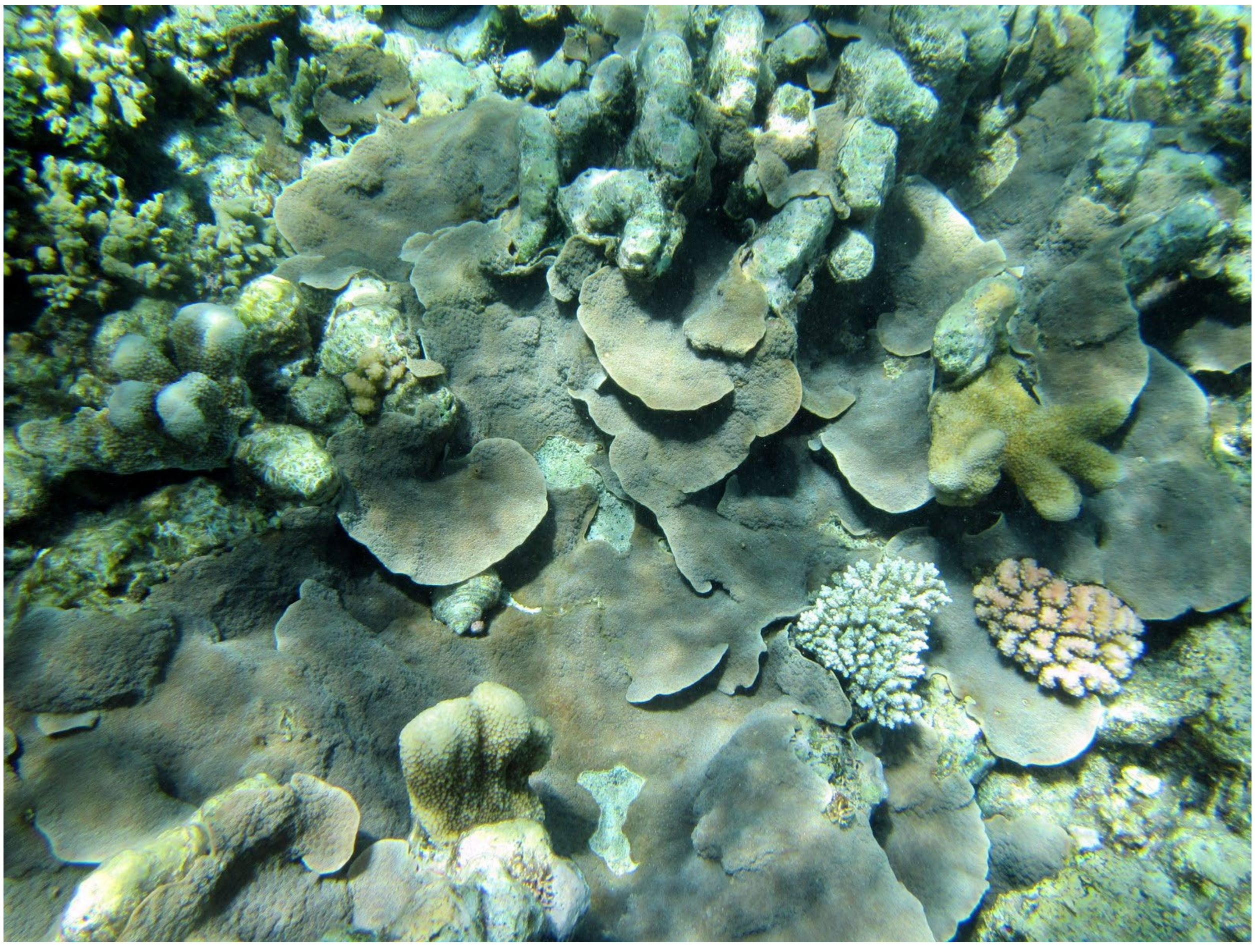
A close-up photo of *Goniastrea stelligera* showing an area where the corallites are more easily seen.

Echinopora

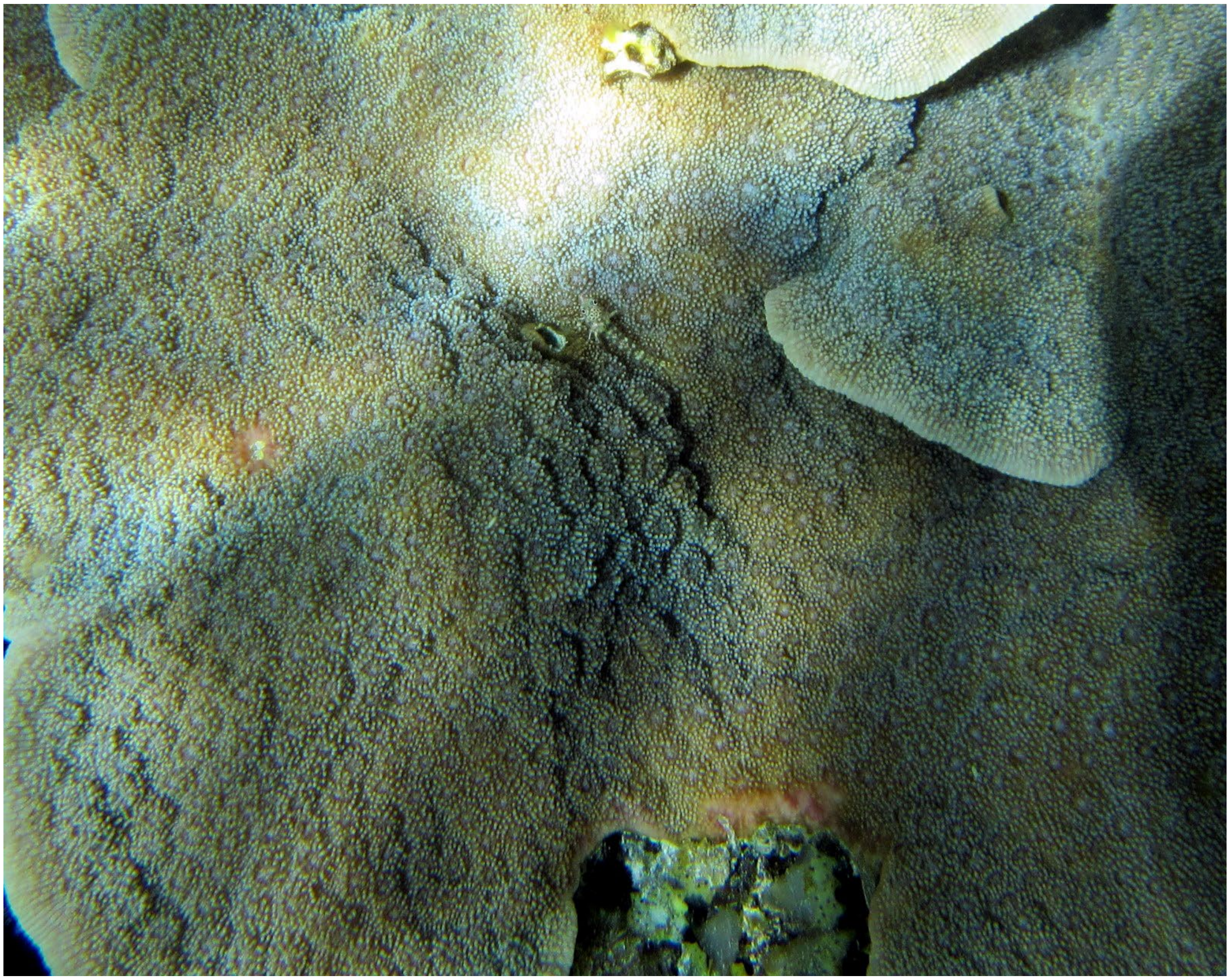
This genus forms thin plates, or encrusting colonies, or branching colonies. The corallites are small, about 3 to 6 mm diameter, and are separated by a groove or spaces. Commonly the corallites project upward a little from the surface. Colonies commonly form plates, unlike *Dipsastrea*, and the corallites are smaller.

Echinopora gemmacea

This species forms plates that are close to the substrate, and are covered with uniform tiny spines between corallites. Corallites are around 4 mm diameter. Corallites are often close together. *Echinopora hirsutissima* is encrusting, has irregular branches or columns, has larger spines, and the corallites tend to be a bit conical.



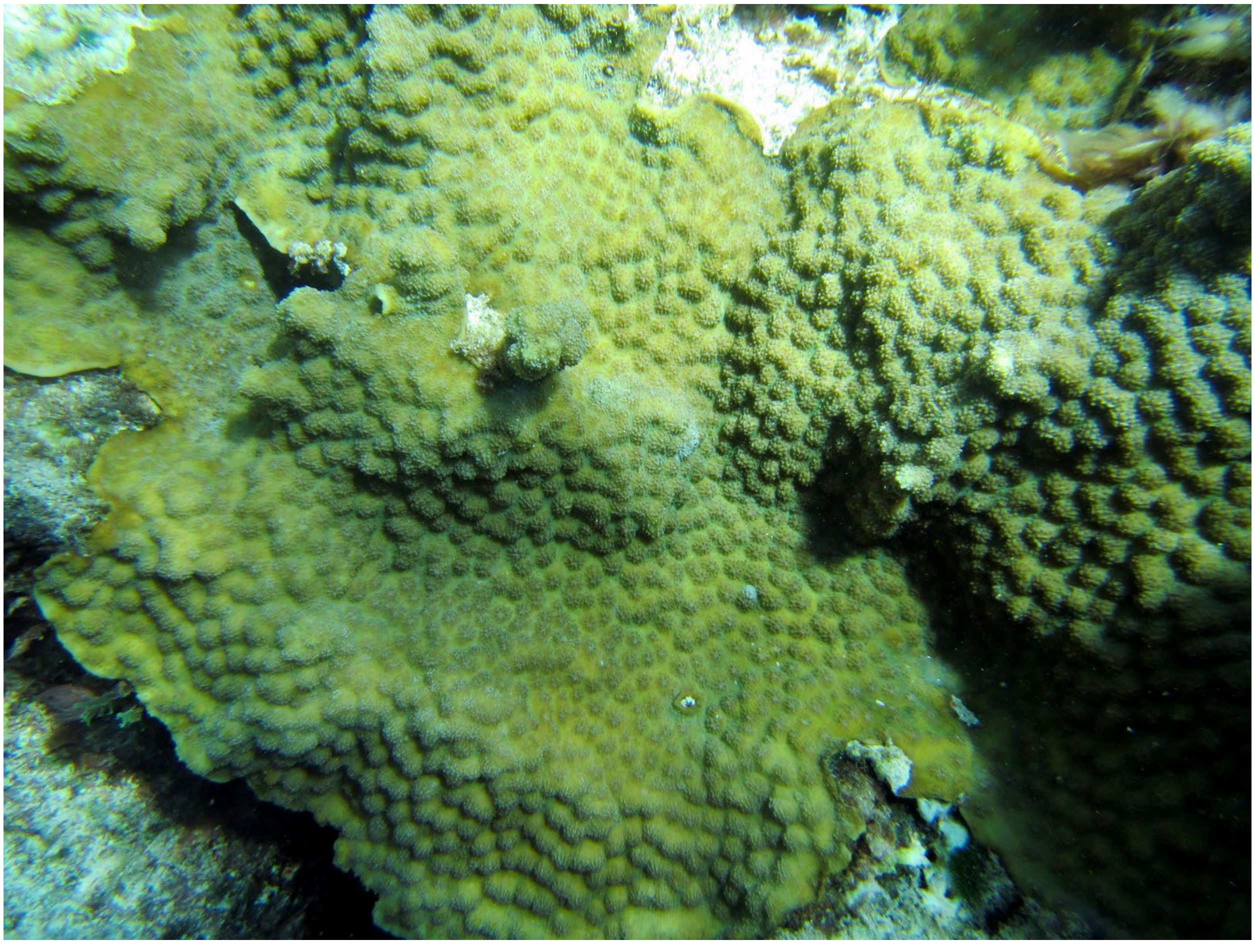
Here thin plates of *Echinopora gemmacea* are near the substrate, but not encrusting.



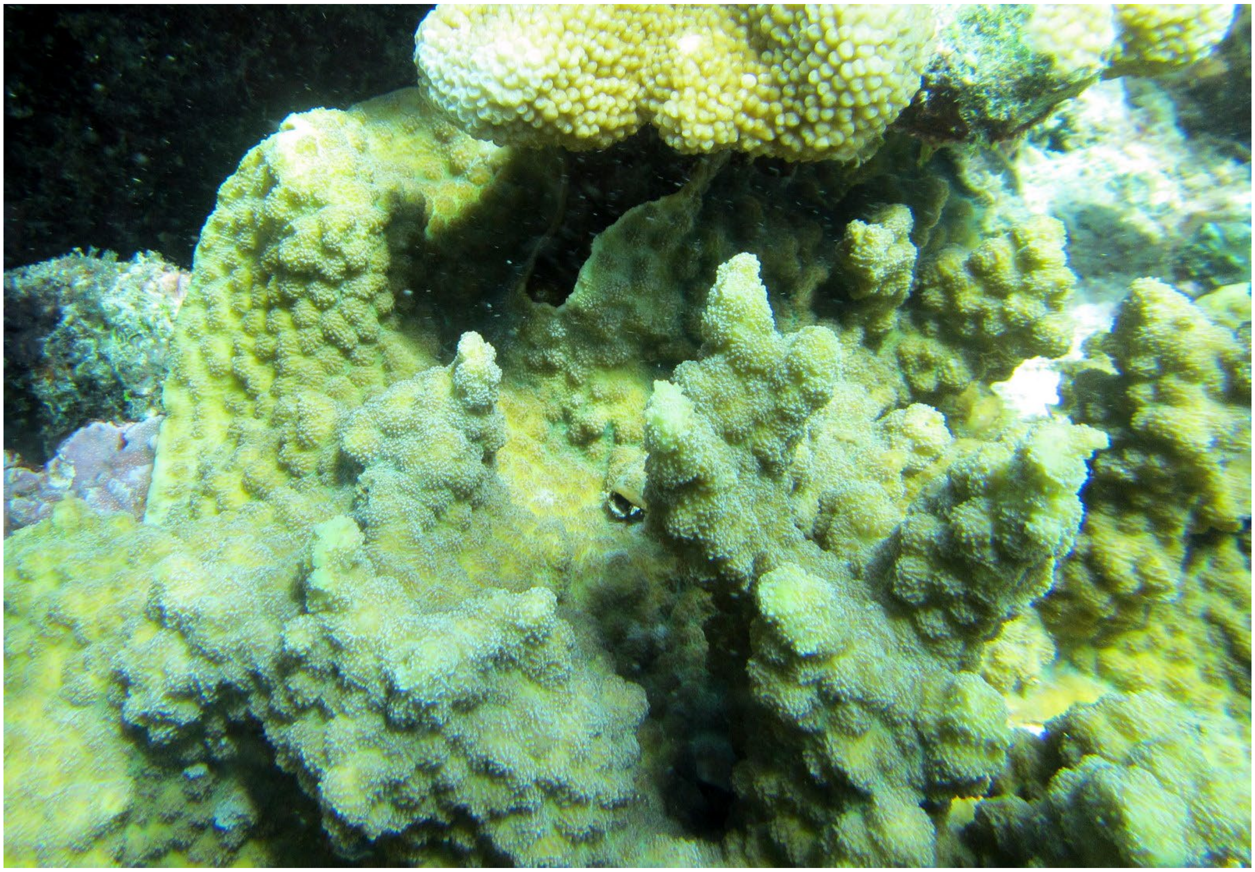
A close-up photo of *Echinopora gemmacea* showing the corallites and the spines.

Echinopora cf. hirsutissima

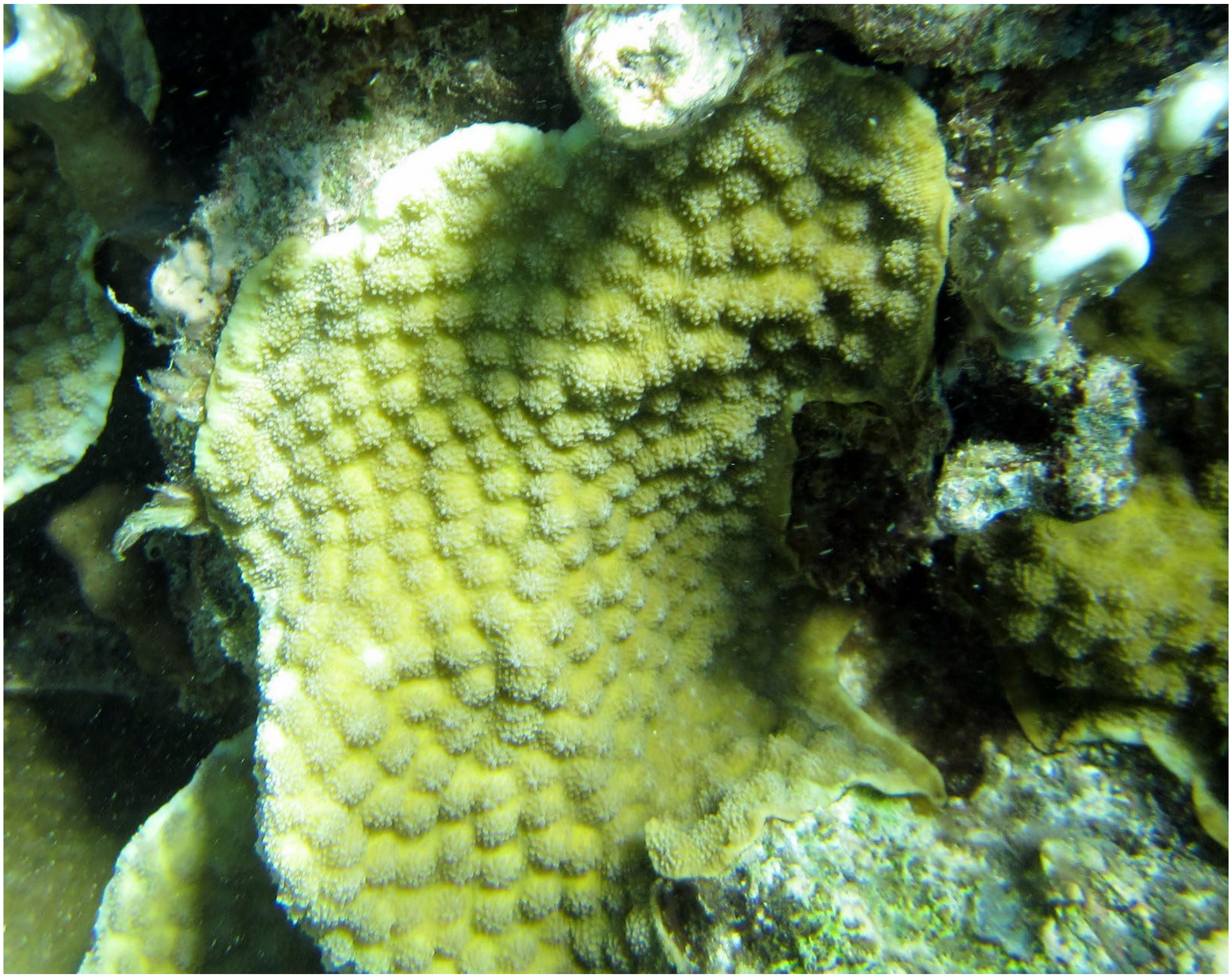
This species in the Federated States of Micronesia forms encrusting sheets with irregular branches or columns growing up from it, which may be tapered. In other places it can also be branching with a plate base, or entirely branching. The corallites are probably a little bit larger than on *Echinopora gemmacea*, and are shaped a little conical. The corallites are more rounded than on *Echinopora gemmacea* and branches or columns are rare on *Echinopora gemmacea*.



An encrusting colony of *Echinopora* cf. *hirsutissima*, with only a few bumps on it.



A portion of a colony of *Echinopora* cf. *hirsutissima* with lumps and columns on it.



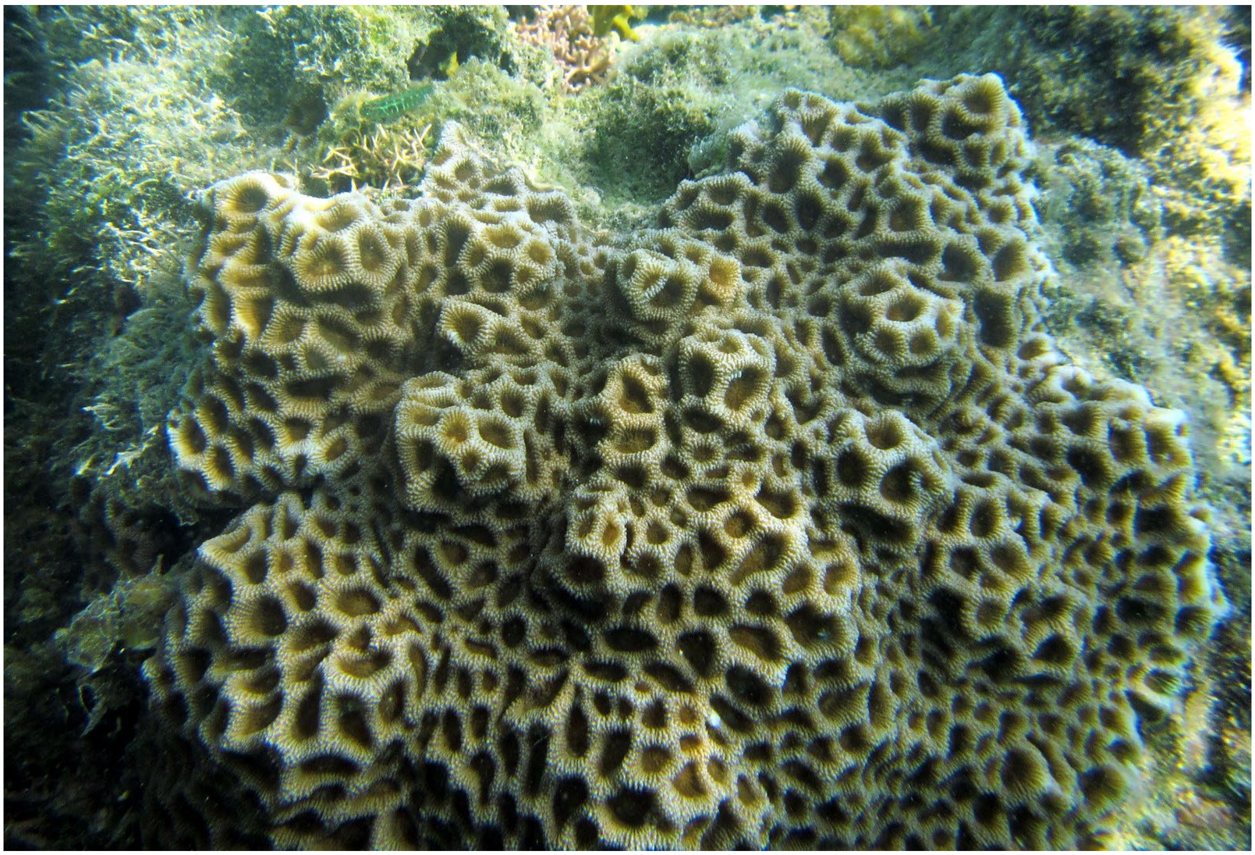
A close-up photo of *Echinopora* cf. *hirsutissima* showing the projecting, rounded, slightly conical corallites, and the spines.

Favites

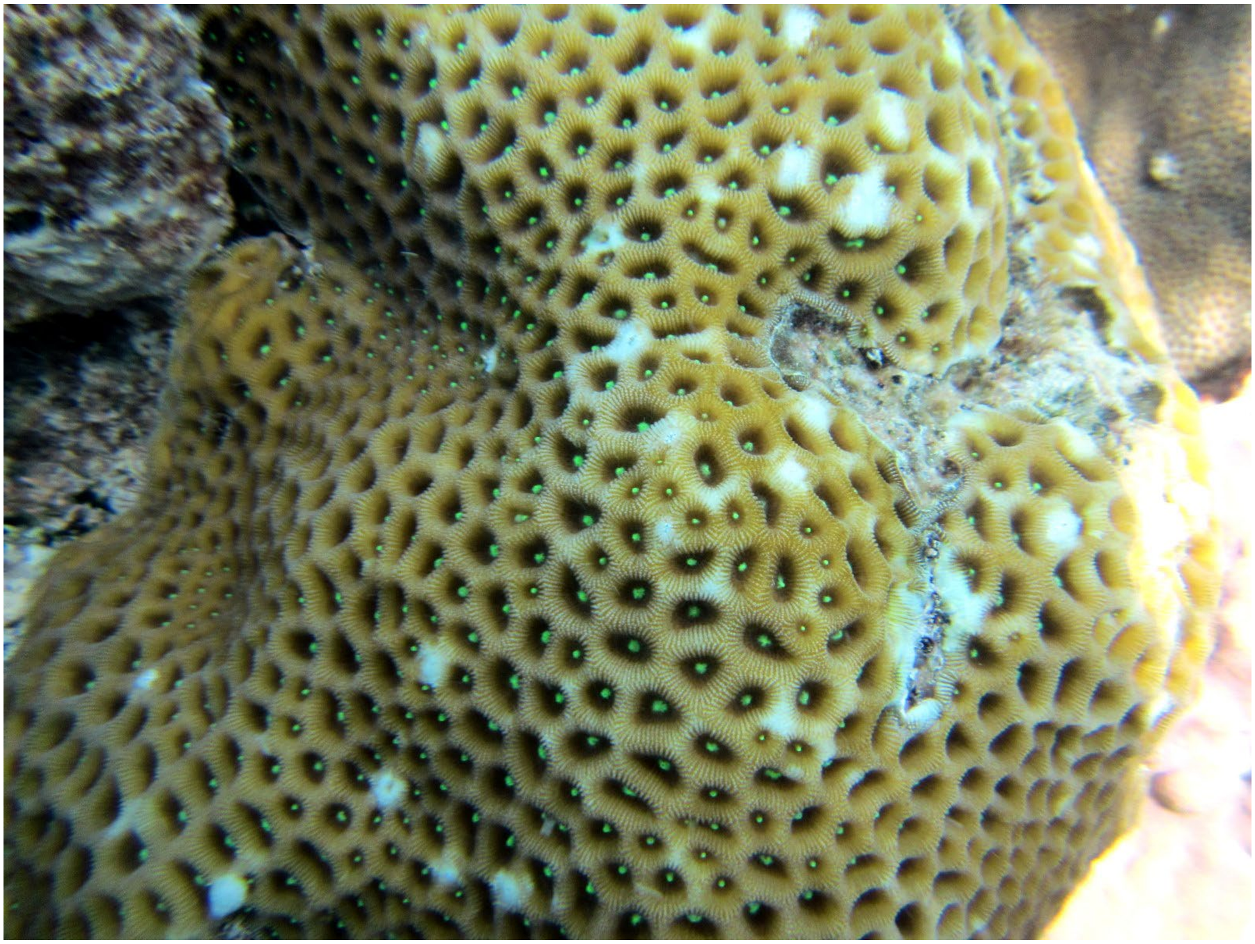
This genus forms encrusting or massive colonies with medium size corallites ranging from about 5 mm diameter to about 1 inch diameter. The corallites have no space between them, they share common walls. *Dipsastrea corallites* do not share common walls. *Goniastrea* is very similar, but walls are thinner in some species and corallites can be smaller.

Favites abdita

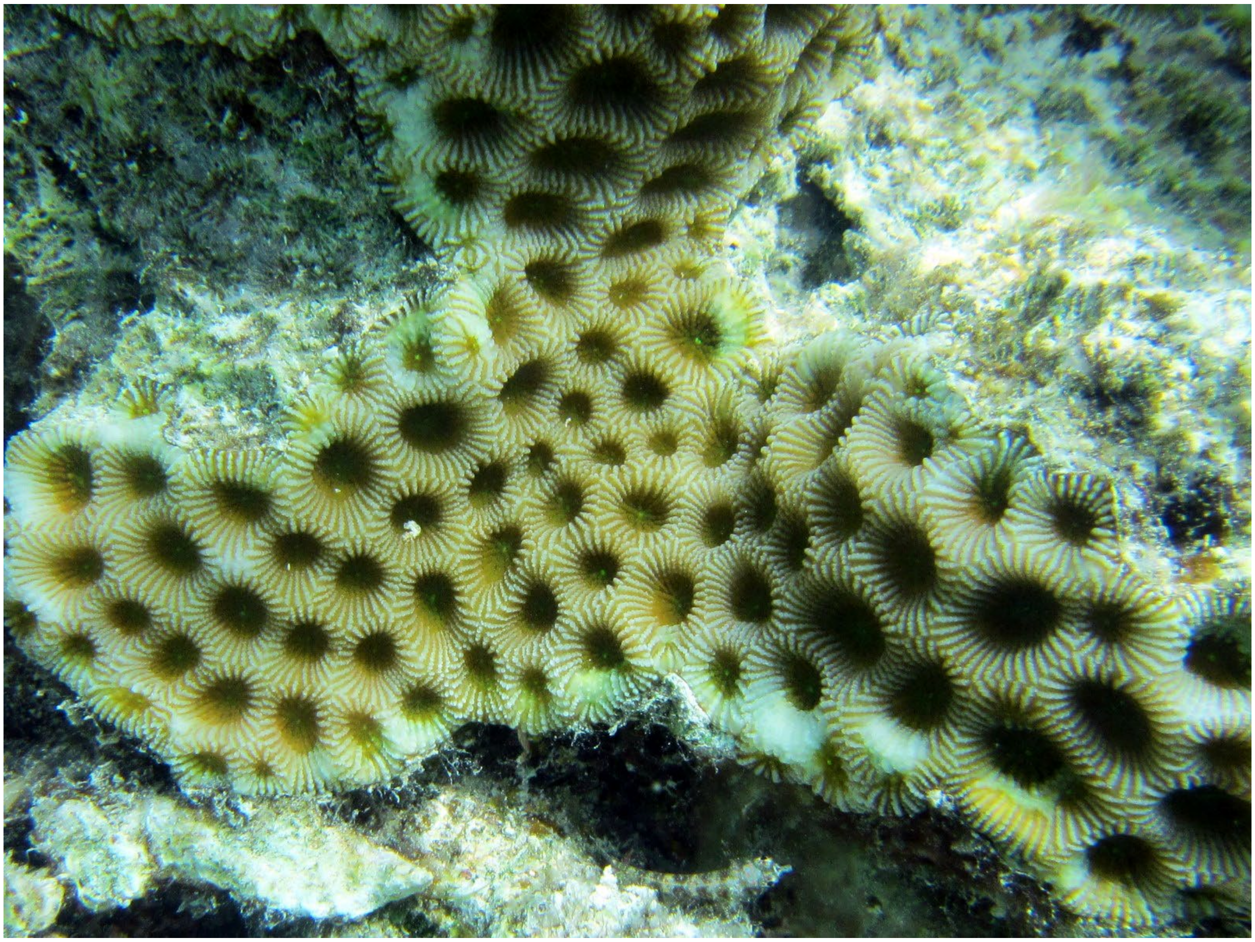
This species forms encrusting or massive colonies that often have a lumpy surface. The ridges between corallites are thin and relatively sharp. The corallites are up to about 1 cm inside diameter. *Favites halicora* is similar but has more rounded, thicker walls.



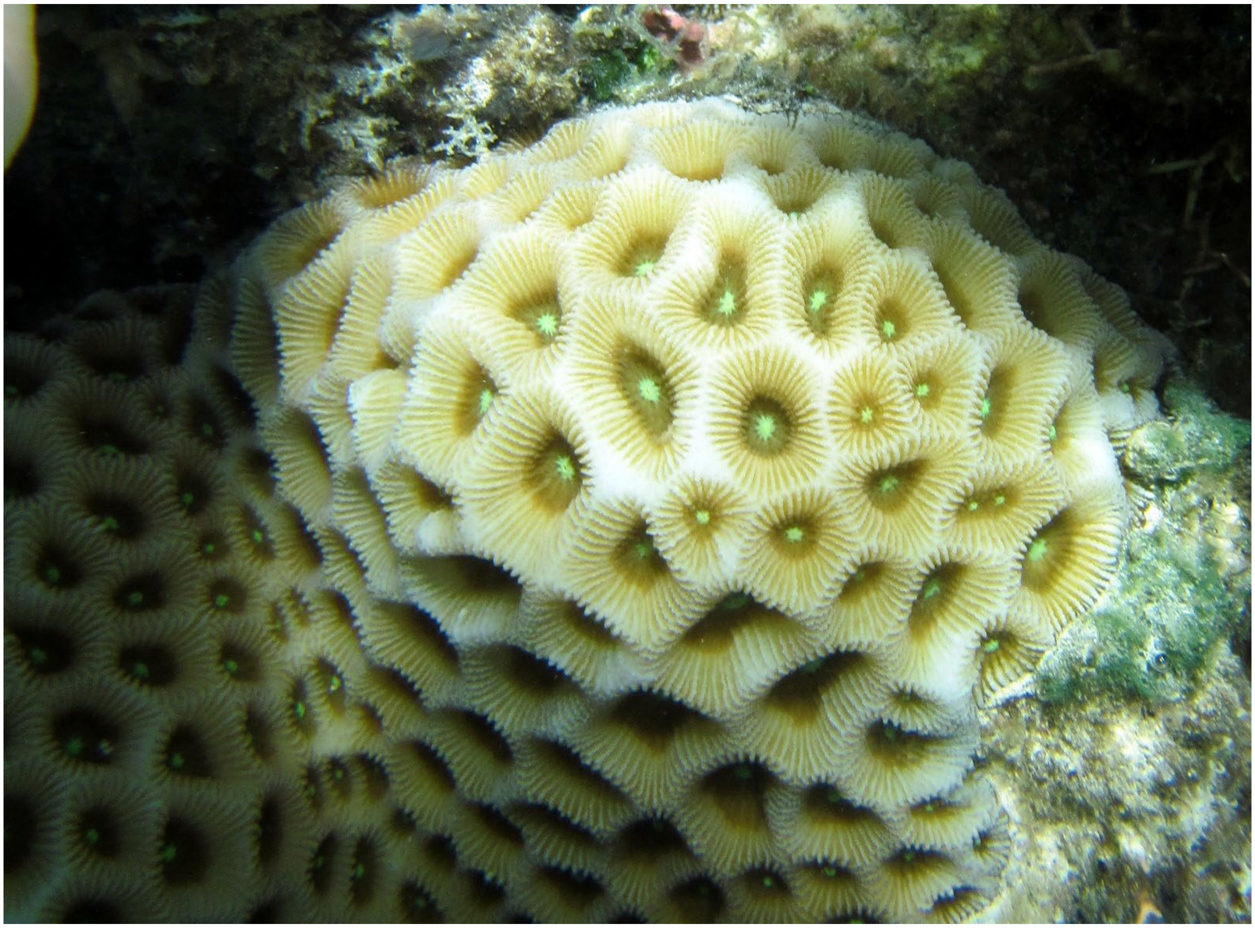
A colony of *Favites abdita*.



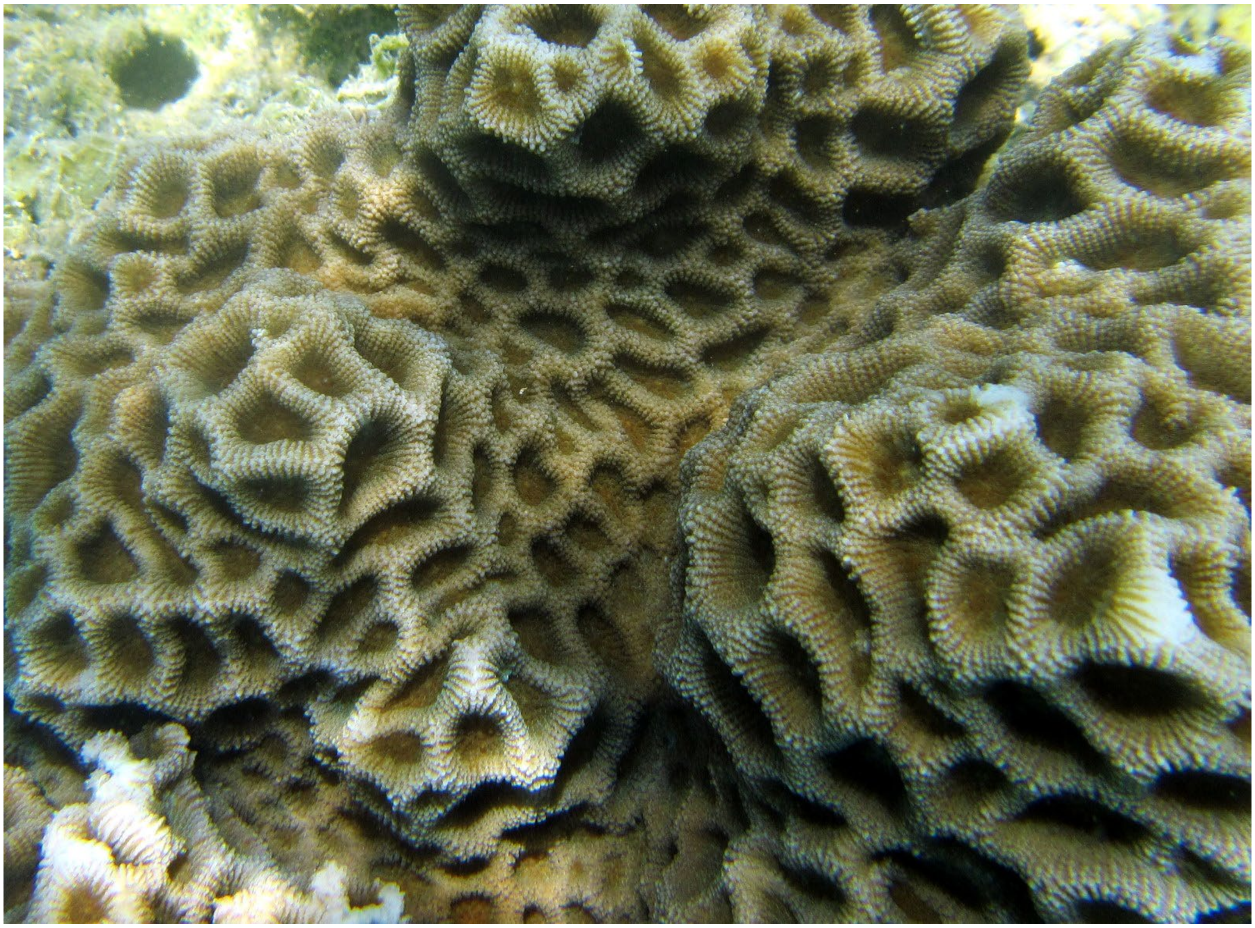
A colony of *Favites abdita* with green polyp centers.



This colony of *Favites abdita* doesn’t have green centers.



This colony of *Favites abdita* with particularly sharp walls.



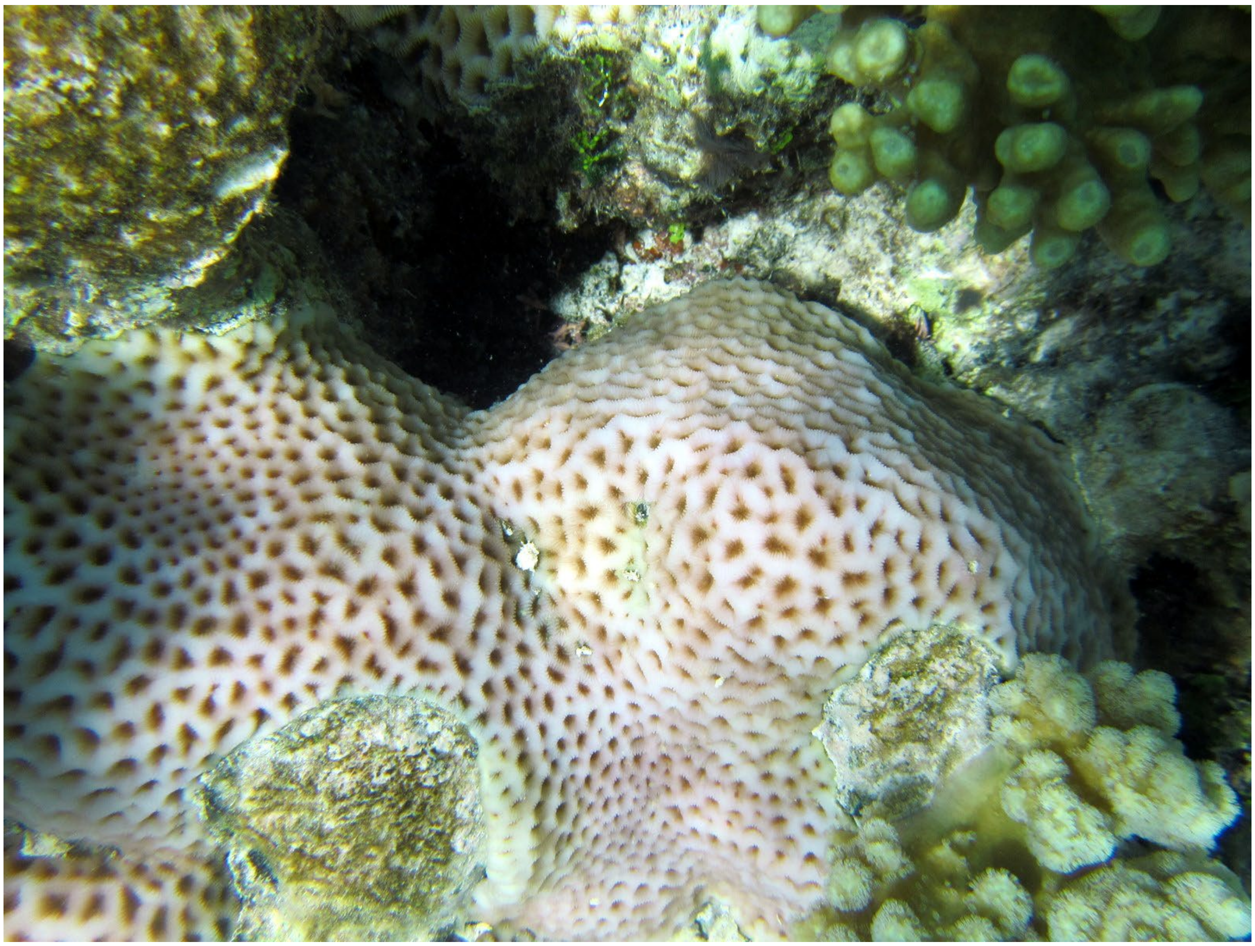
A close-up of *Favites abdita*.

Goniastrea

This genus forms colonies that are massive or encrusting, with corallites that share a common wall like *Favites* and don't have a groove between them like *Dipsastrea*. Corallites are often small and the common wall or ridge is often thin, but not always.

Goniastrea pectinata

This species has larger corallites than several other species of *Goniastrea* (but not all), and the walls are commonly fairly thick. Colonies are massive and often lumpy. The corallites range from polygonal and nearly circular to somewhat elongated, and there are always a few elongated corallites that have two or more "centers" or mouths.

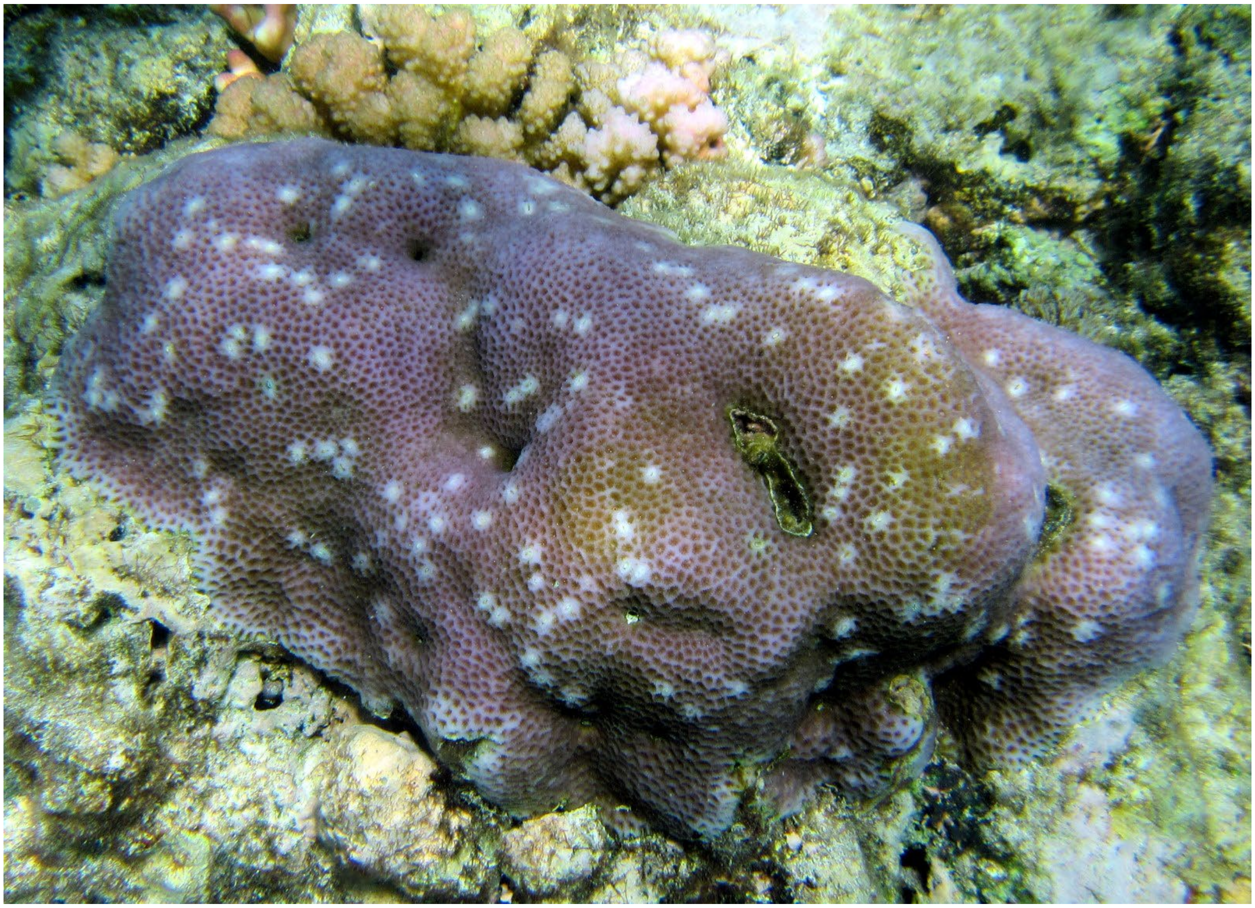


A colony of *Goniastrea pectinata* showing the typical corallite shapes, wall thickness, and color.


A close-up of *Goniastrea pectinata*, showing the corallite shapes and the thick walls.

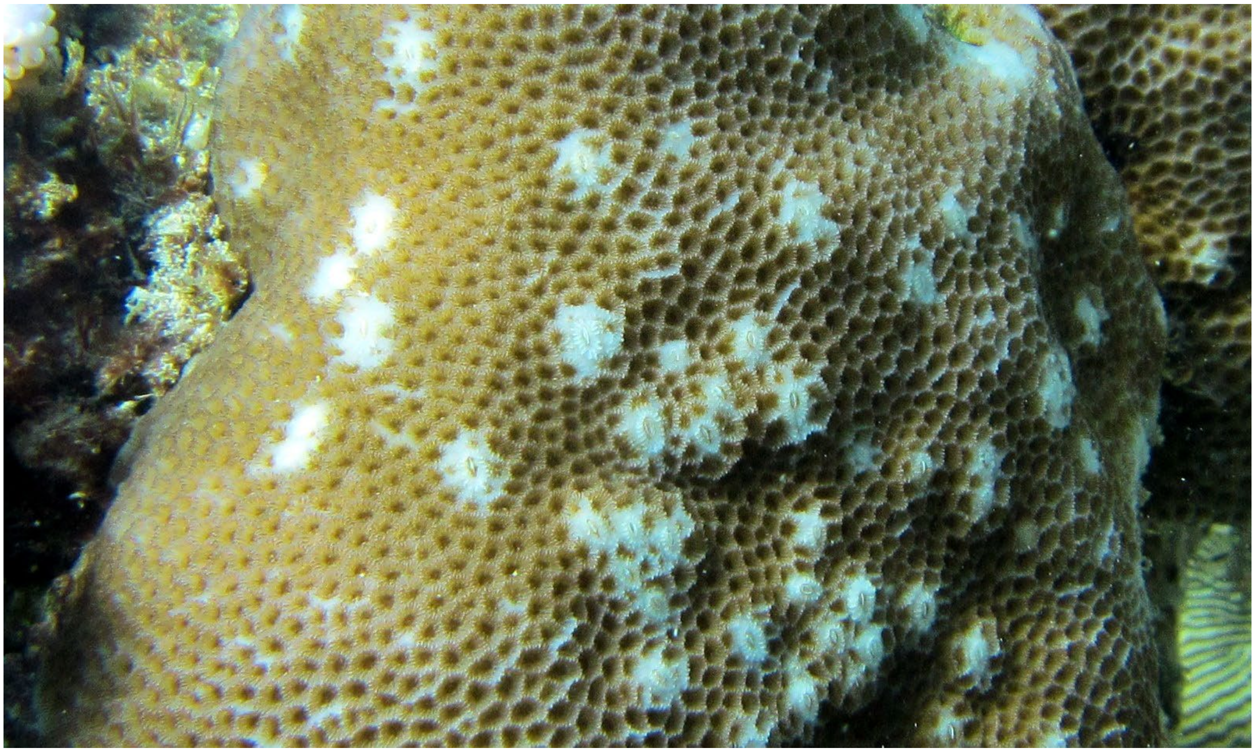
Goniastrea minuta

This species makes rounded massive colonies or encrusting colonies with lumps, with small, recessed corallites. There are thin, sharp walls between the corallites and the corallites are relatively shallow. Often, colonies have barnacles which look like white spots. Colonies are usually a reddish-brown color but sometimes can be purple. Corallites are smaller than on most other *Goniastrea* and it is the only species that commonly has barnacles.

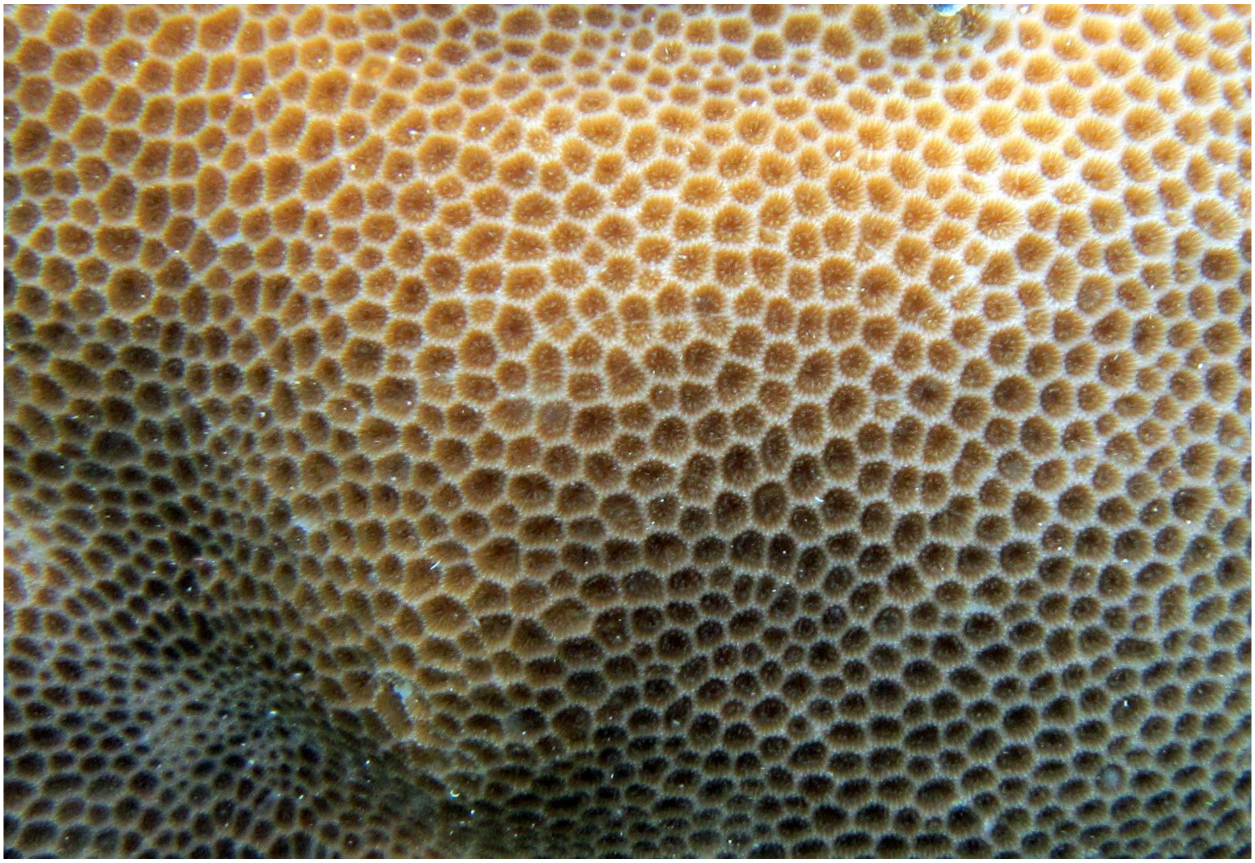


A purple colony of *Goniastrea minuta* with many barnacles indicated by the white spots.

A colony of *Goniastrea retiformis*.



A close-up photo of *Goniastrea minuta* showing the thin walls between corallites, which are relatively shallow. The barnacle in the center of the white bumps is easily seen.



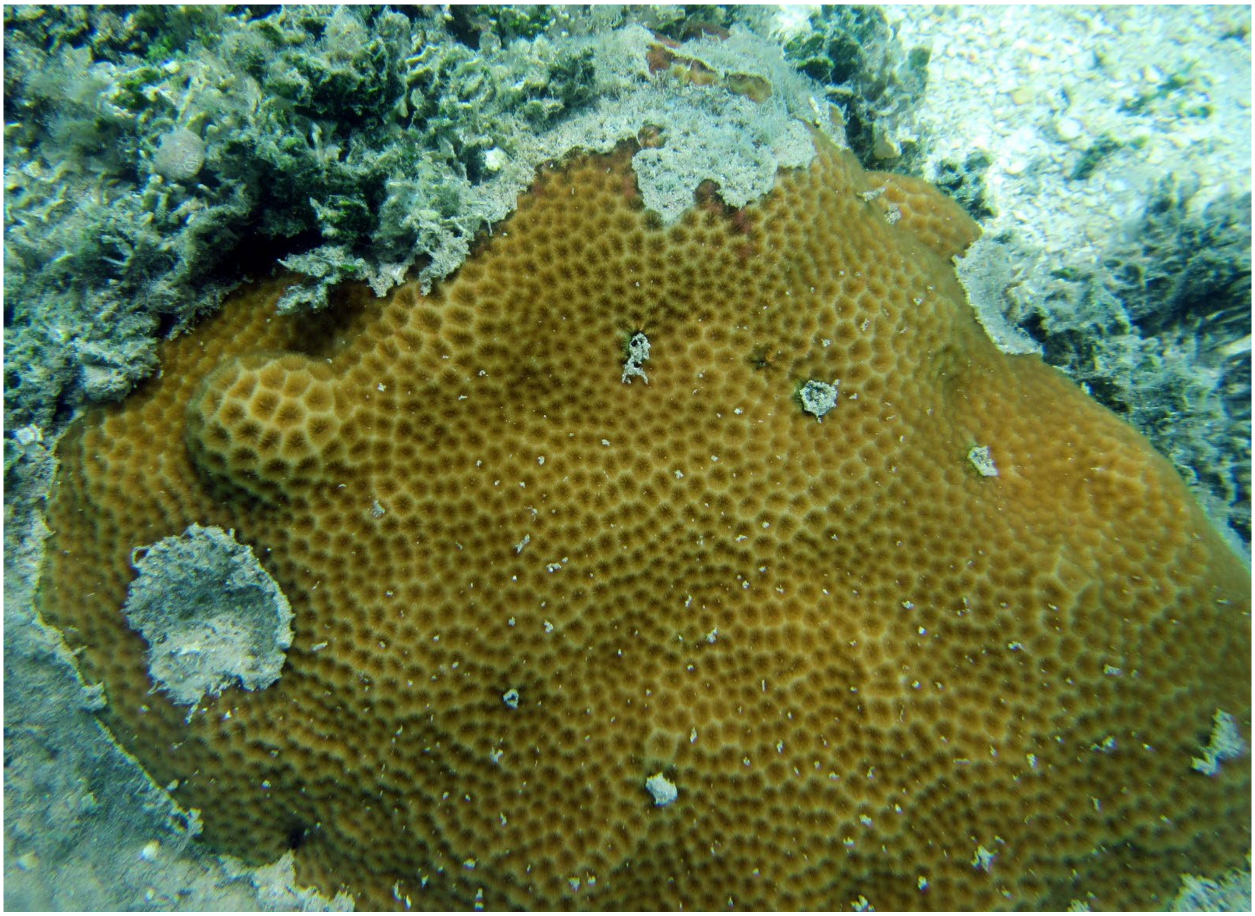
A close-up photo of the surface of *Goniastrea minuta*.

Leptastrea

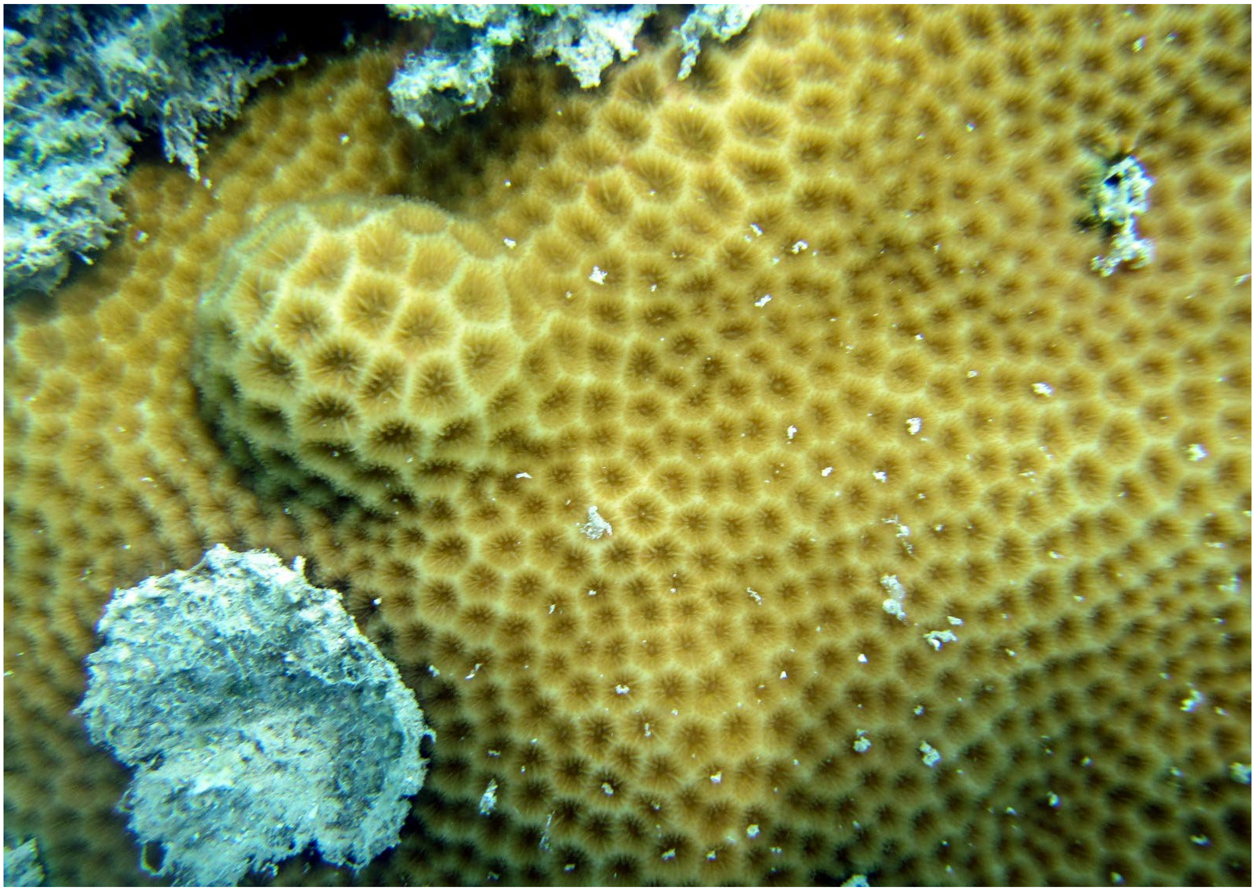
This genus forms encrusting colonies with small corallites, smaller than a small finger. The corallites share common walls. The corallites are smaller than on most *Goniastrea* and the walls may be thicker and all species are encrusting.

Leptastrea purpurea

This species forms encrusting colonies with corallites that are larger in some areas of the colony than others.



A colony of *Leptastrea purpurea*.



A close-up photo of a colony of *Leptastrea purpurea*.

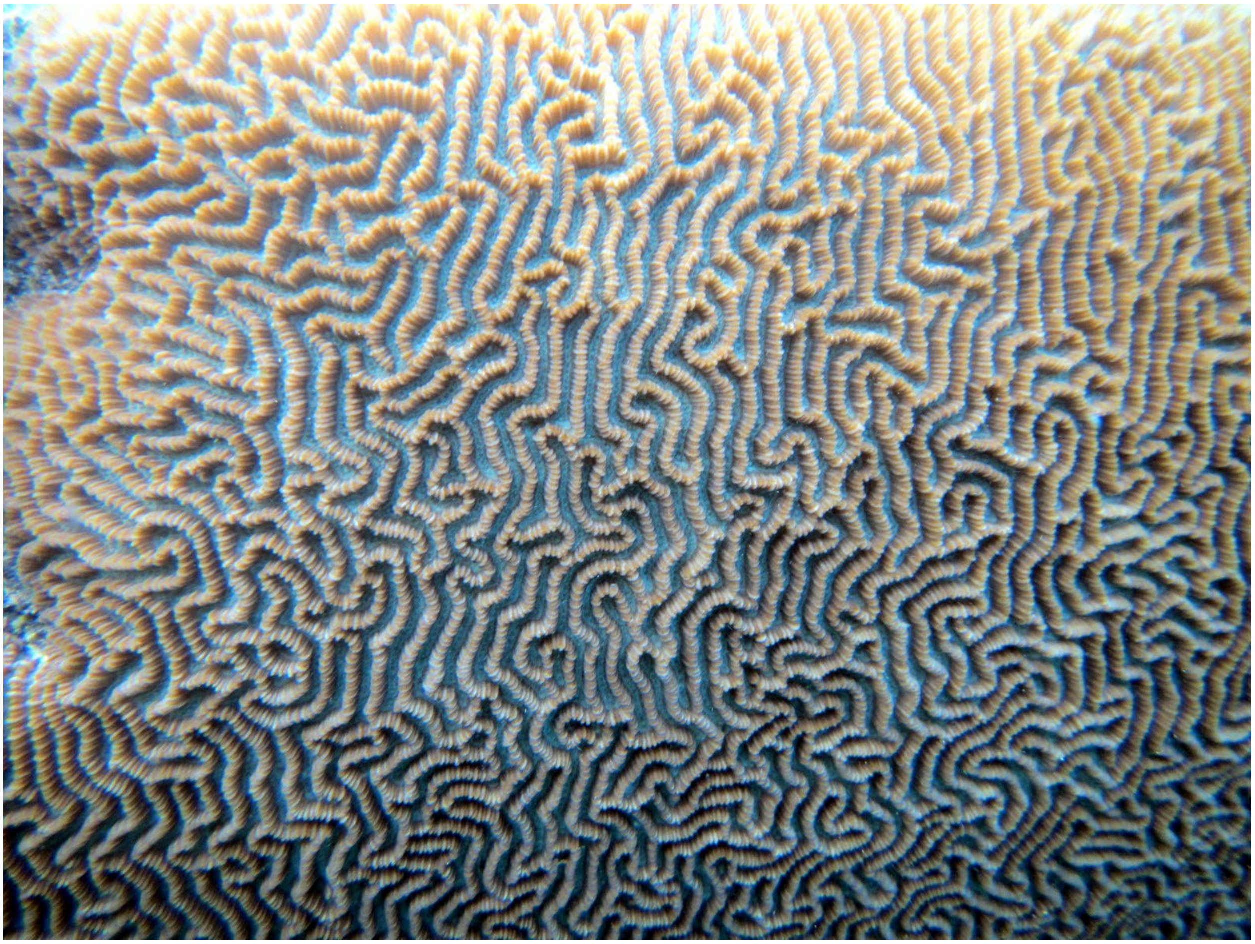
Platygyra

This genus forms massive colonies with thin, winding, meandering ridges on the surface. The ridges can be long or quite short. When the ridges are long we call them "meandroid" or "brain corals" but if the ridges are short and intersect we don't.

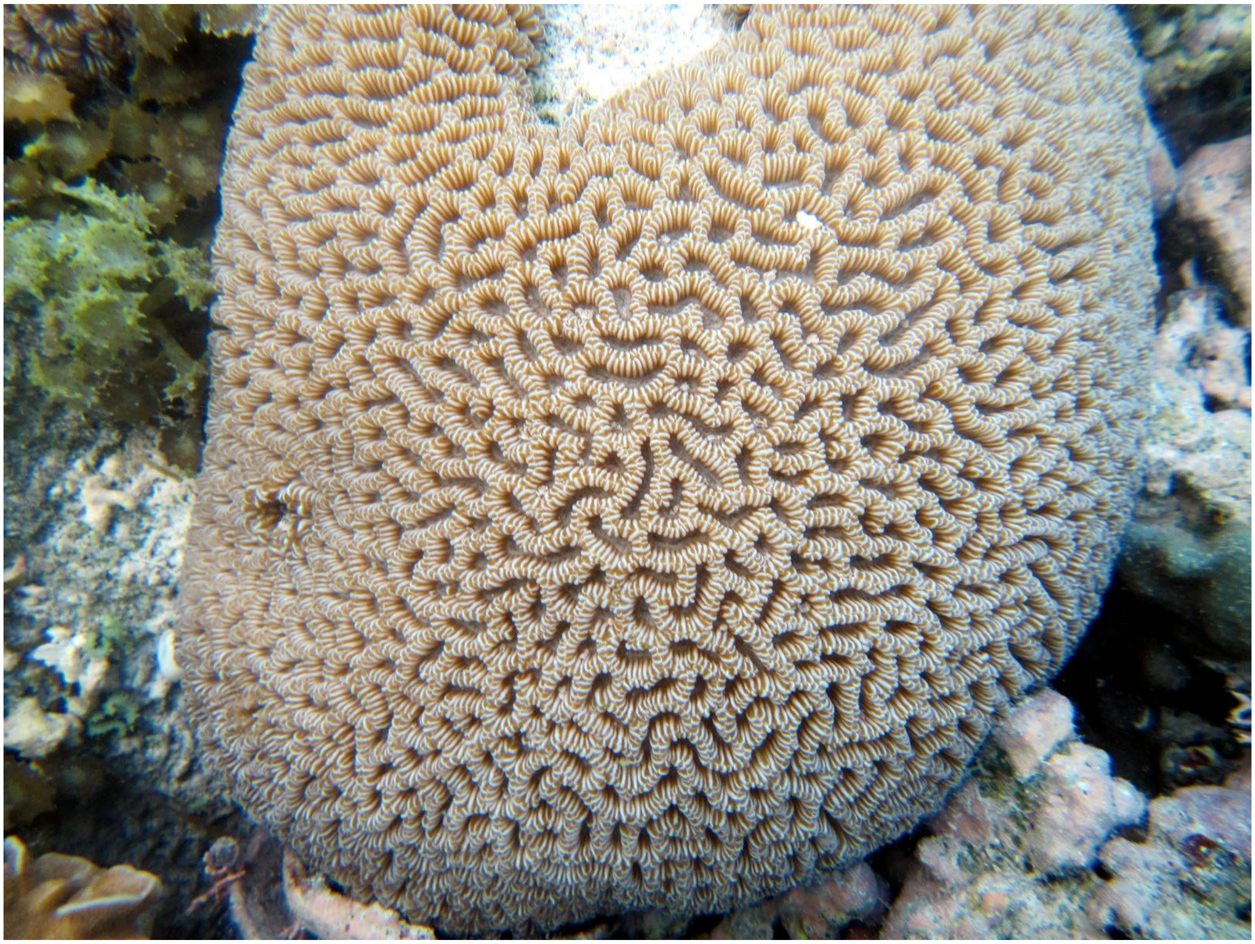
Platygyra sinensis "meandroid" or "brain coral"

This species forms massive colonies with small, rounded ridges that usually meander on the surface and long, but sometimes are short and connect with other ridges. The width of the ridges varies between colonies. There are smaller ridges on the sides of the main ridges, the smaller ridges being septa. The septa have two different sizes, and usually the larger septa are a lighter color. Everything is very uniform in this species. The ridges are thinner than on *Platygyra daedalea* and every other septum is a lighter color.

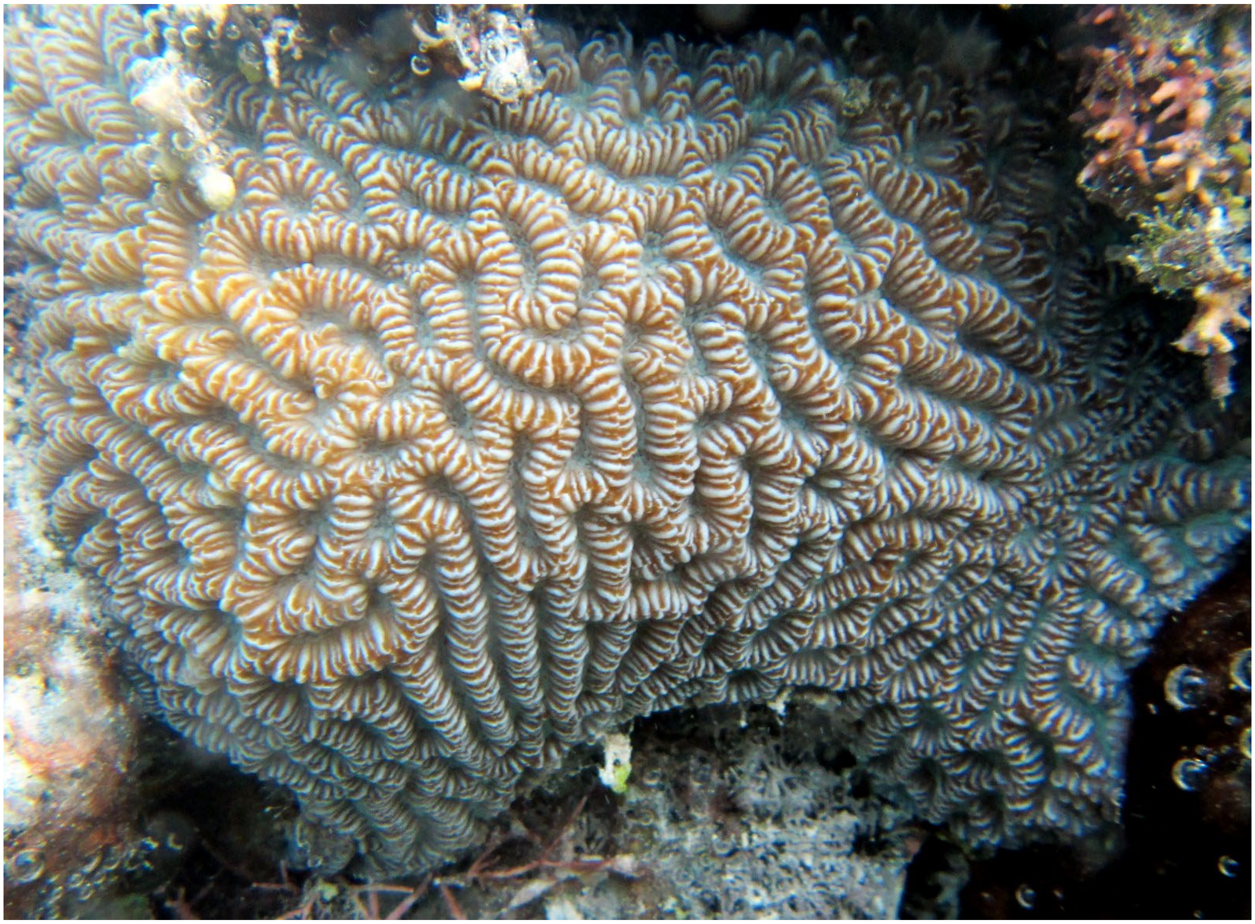
A very large colony of *Platygyra sinensis.* Most colonies are much smaller and a more reddish color.



A colony of *Platygyra sinensis* with long meandering thick ridges.



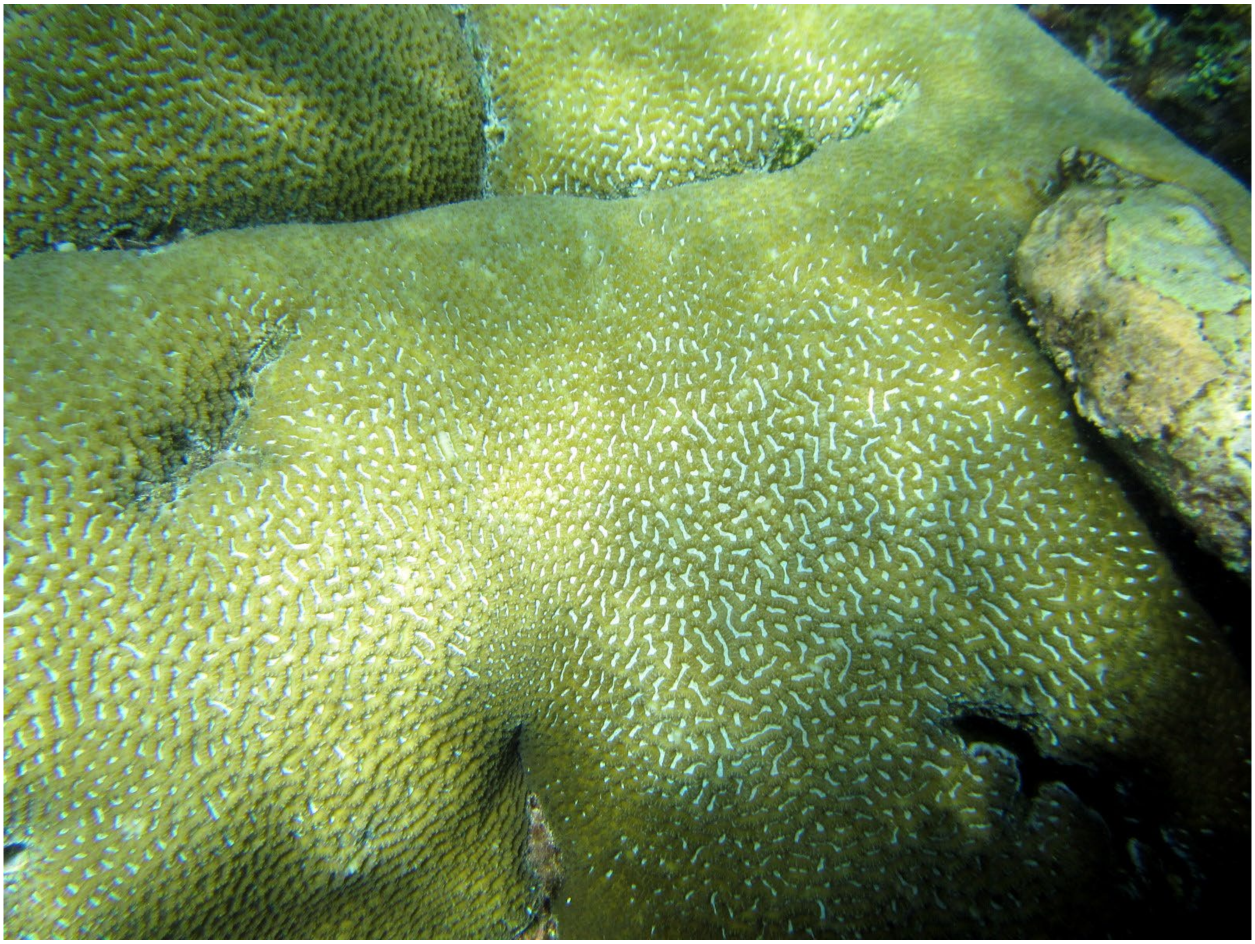
A colony of *Platygra sinensis* with thicker ridges that don't go very far before they join other ridges.



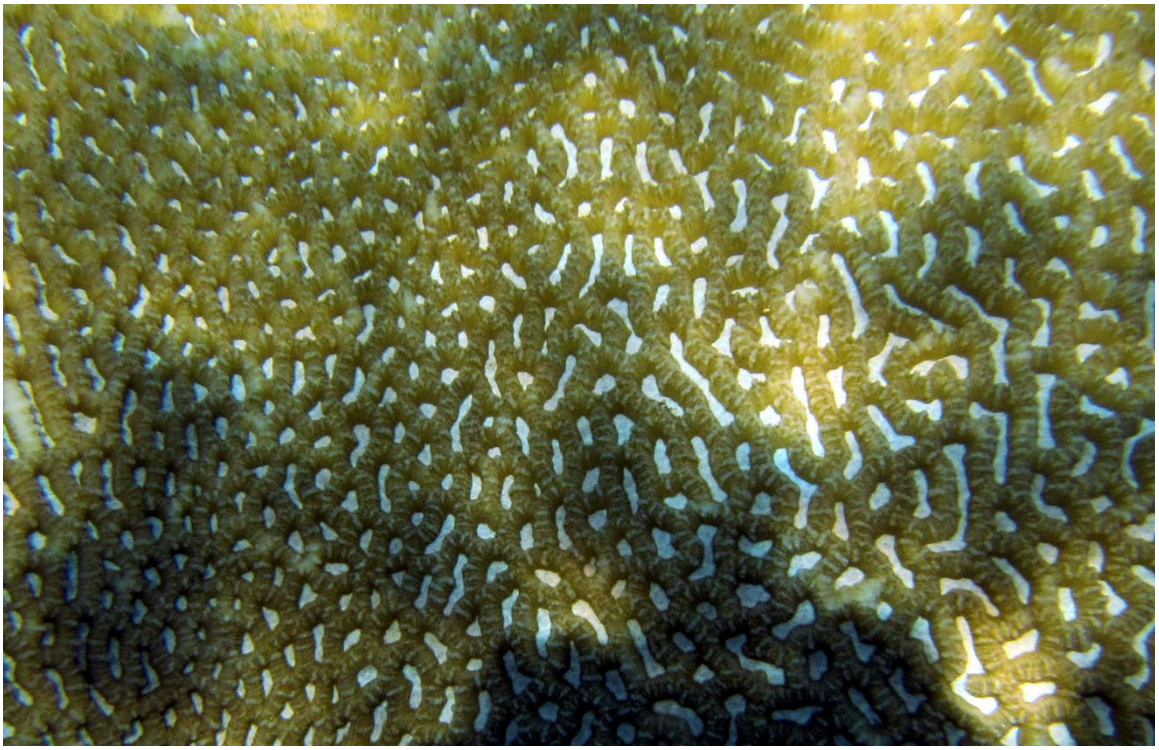
A close-up of a colony of *Platygyra sinensis* showing the alternating color and size of the septa.

Platygyra pini

This species forms massive or encrusting colonies with ridges on them which intersect often, enclosing short valleys. The valleys are shorter than on *Platygyra sinensis* or *Platygyra daedalea*.



A colony of *Platygyra pini*.



A close photo of *Platygyra pini*.

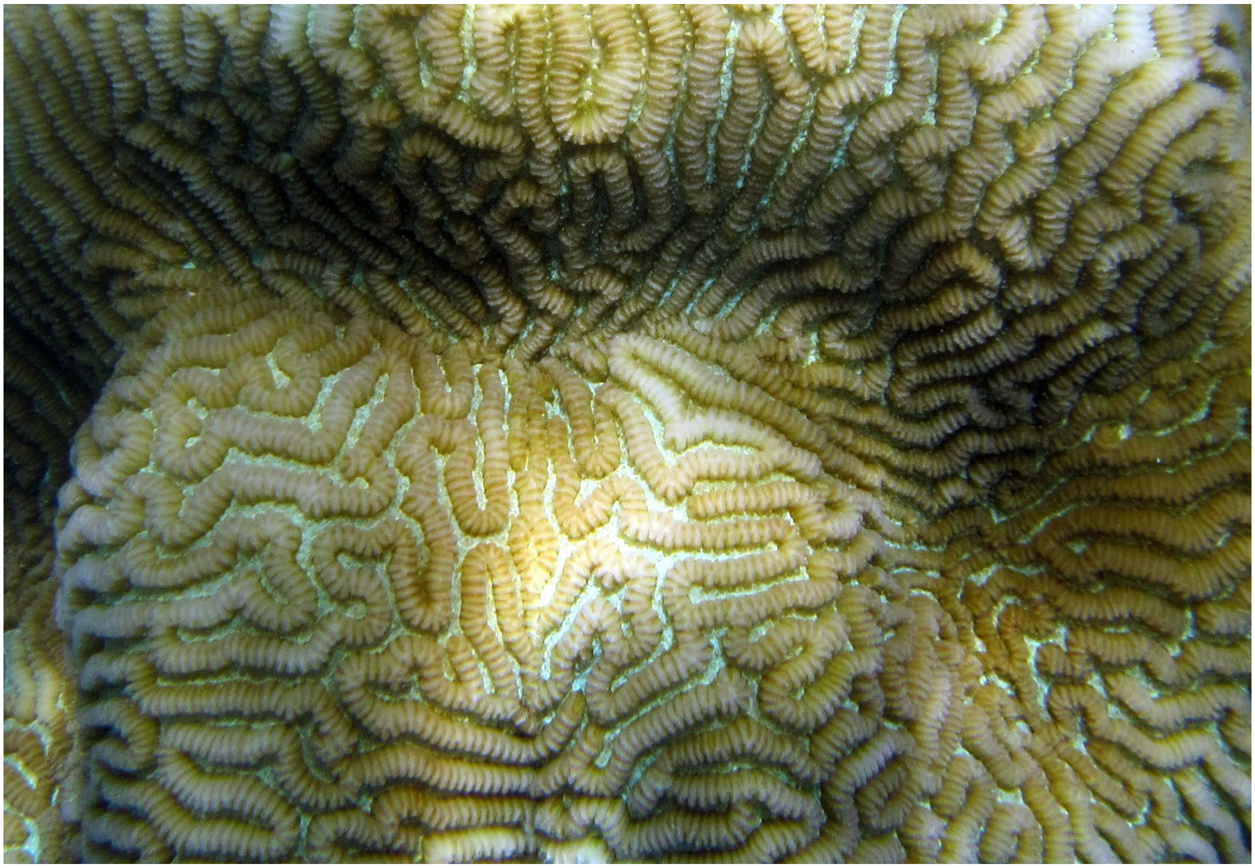
Leptoria

This genus forms massive or encrusting colonies that have meandering ridges on the surface. The ridges are smaller than on *Platygyra* and are the smallest on any "brain coral."

Leptoria phrygia

The species is the only common species of *Leptoria* and has relatively uniform septa on ridges. Most colonies are around a foot in diameter or less.

A colony of *Leptoria phrygia*.

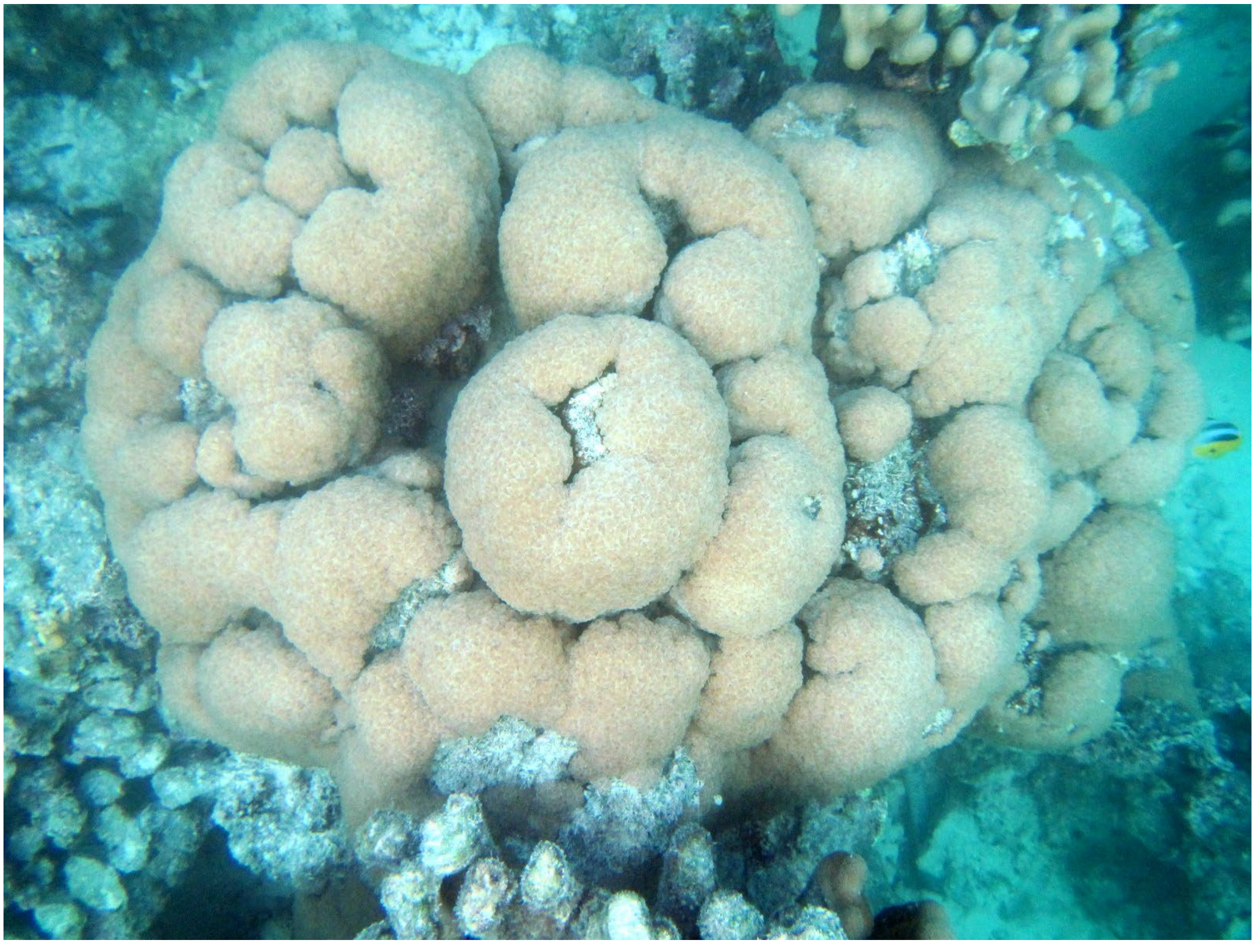

A close-up photo of *Leptoria phrygia*.

Physogyra

This genus forms massive colonies covered with small oval bubbles.

Physogyra lichtensteini — Vulnerable

This species forms colonies that can be up to at least a meter across. Colonies are covered with small oval bubbles, about 3 mm wide and 5 mm long. The bubbles are much smaller than on *Plerogyra sinuosa*.



A large colony of *Physogyra lichtensteini* composed of many lobes.

A close-up photo of the small bubbles on *Physogyra lichtensteini*.

Plerogyra

This genus forms massive or branching colonies with large bubbles on them. *Physogyra* has much smaller bubbles.

Plerogyra sinuosa

This species forms massive colonies covered by large oval bubbles. Sometimes the bubbles have a white stripe going lengthwise on the oval bubbles. *Plerogyra simplex* is branching.

A very large colony of *Plerogyra sinuosa*. Colonies are usually not this large.

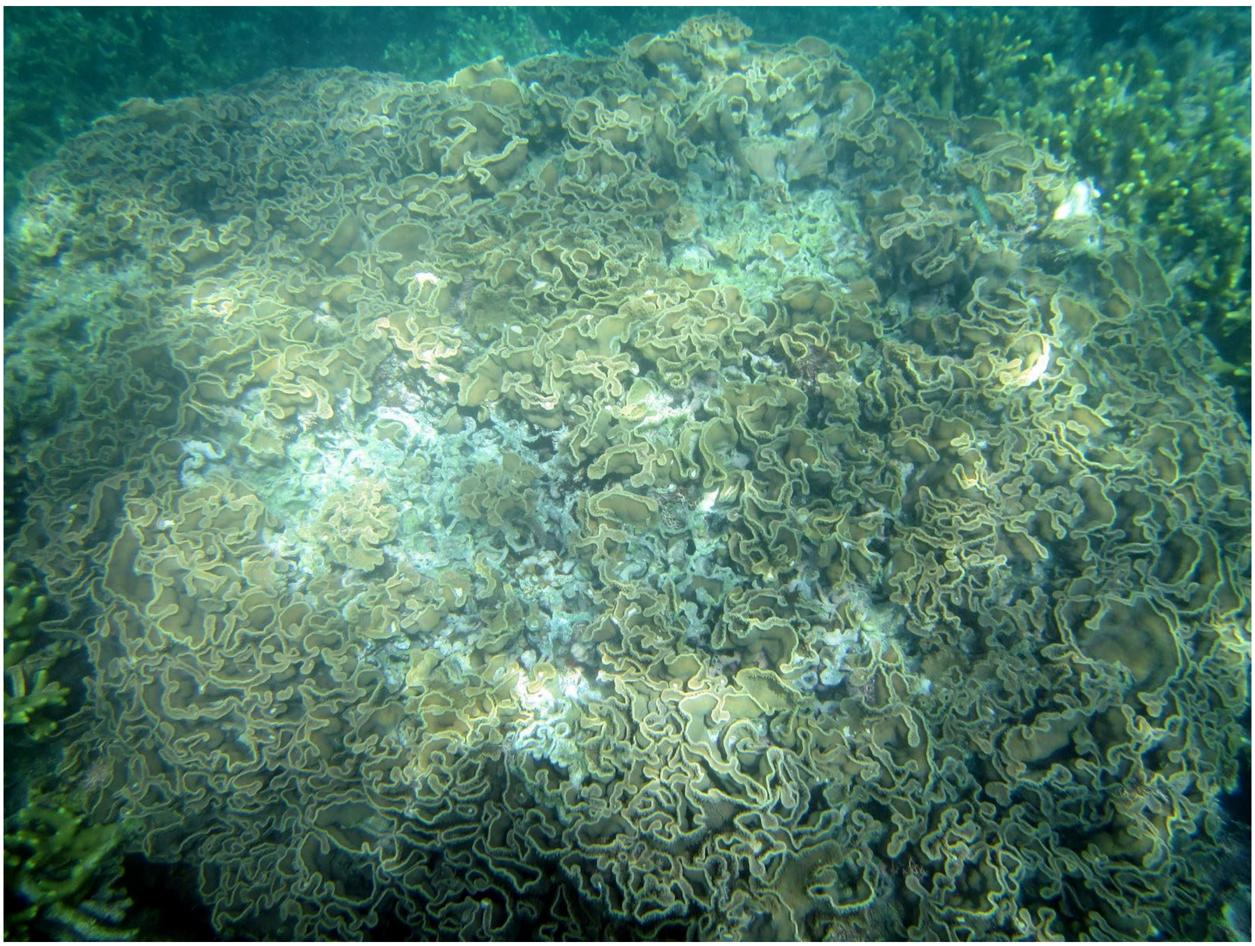
A close-up photo of the large bubbles on *Plerogyra sinuosa*.

Turbinaria

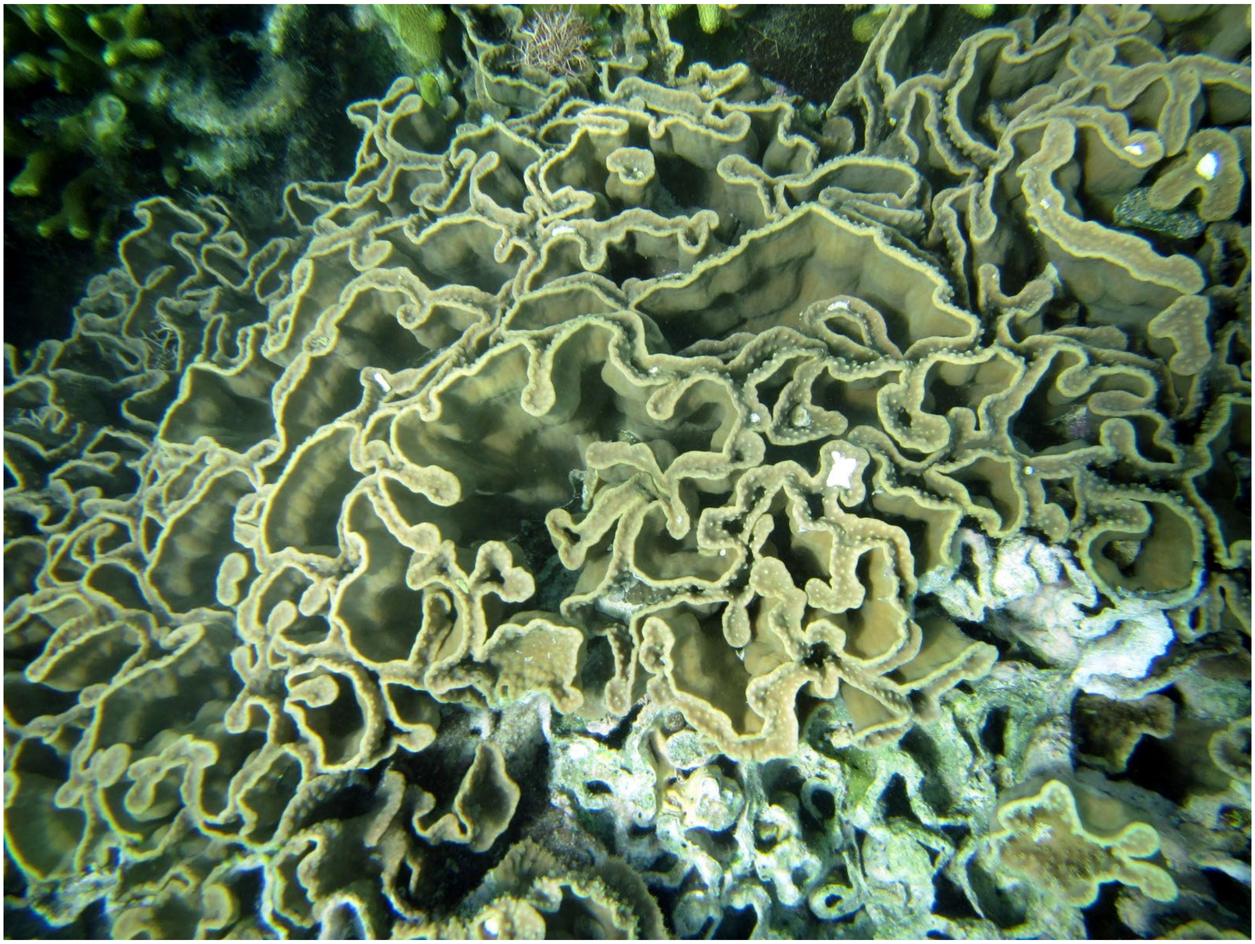
Most species of *Turbinaria* form plates with polyps (and corallites) on only one side, but a few are encrusting. The surface between corallites is smooth and the sides of corallites are smooth as well. Species differ in how large the corallites are, colony color, and whether colonies are plates or encrusting. Plates on *Echinopora* are usually near horizontal but can be at any angle in *Turbinaria*. *Echinopora* is spiny while *Turbnaria* is smooth.

Turbinaria mesenterina Vulnerable EDGE

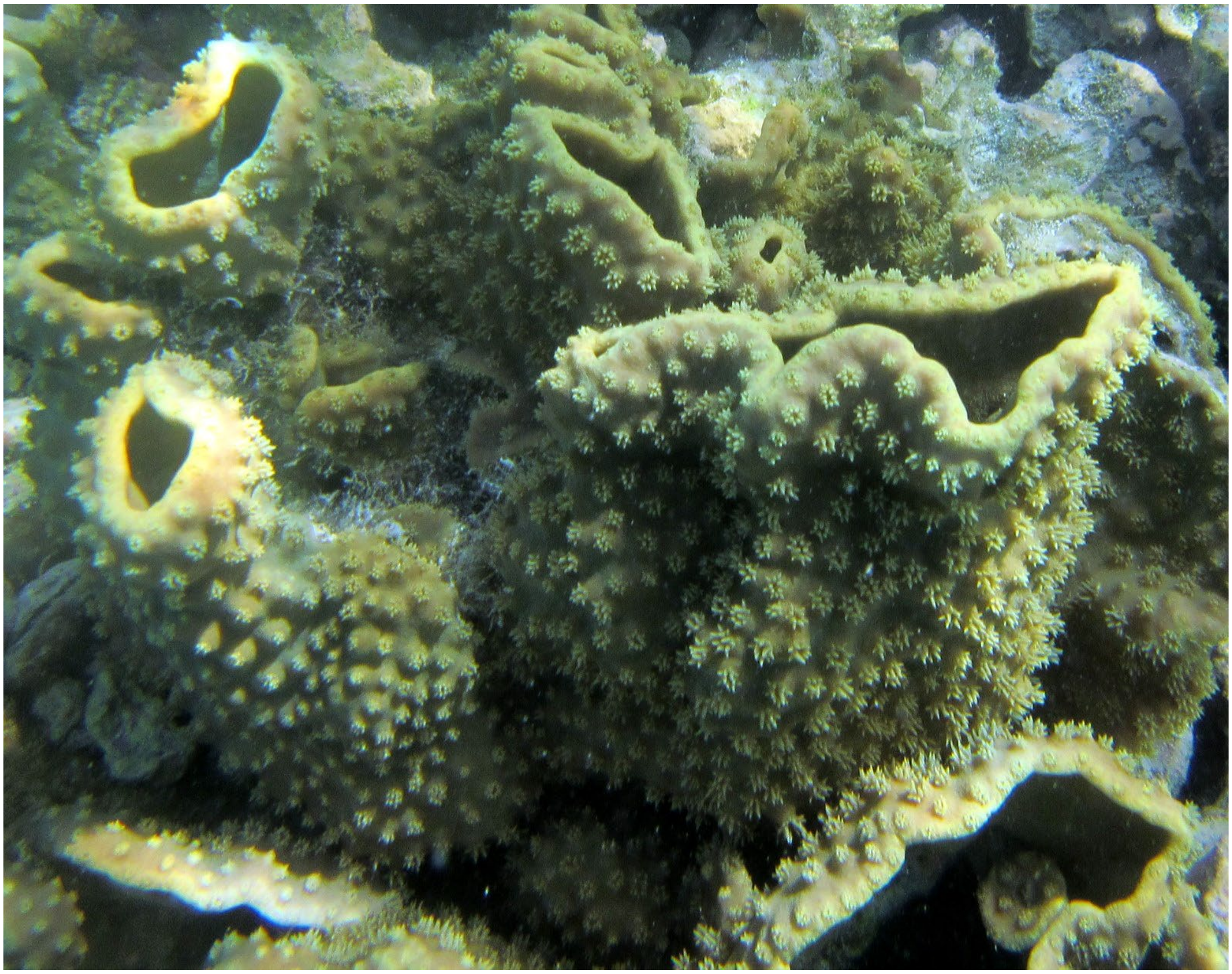
This species forms thin plates that can be vertical or horizontal or in between. There may be many plates in a colony. The upper surface of the plate has small polyps with smooth spaces between them. The polyps are about 3 mm diameter. The undersides of plates are smooth. Colonies are brown, grey or greenish. *Turbinaria reniformis* is nearly identical, except that it is yellow.



A large colony of *Turbinaria mesenterina*.



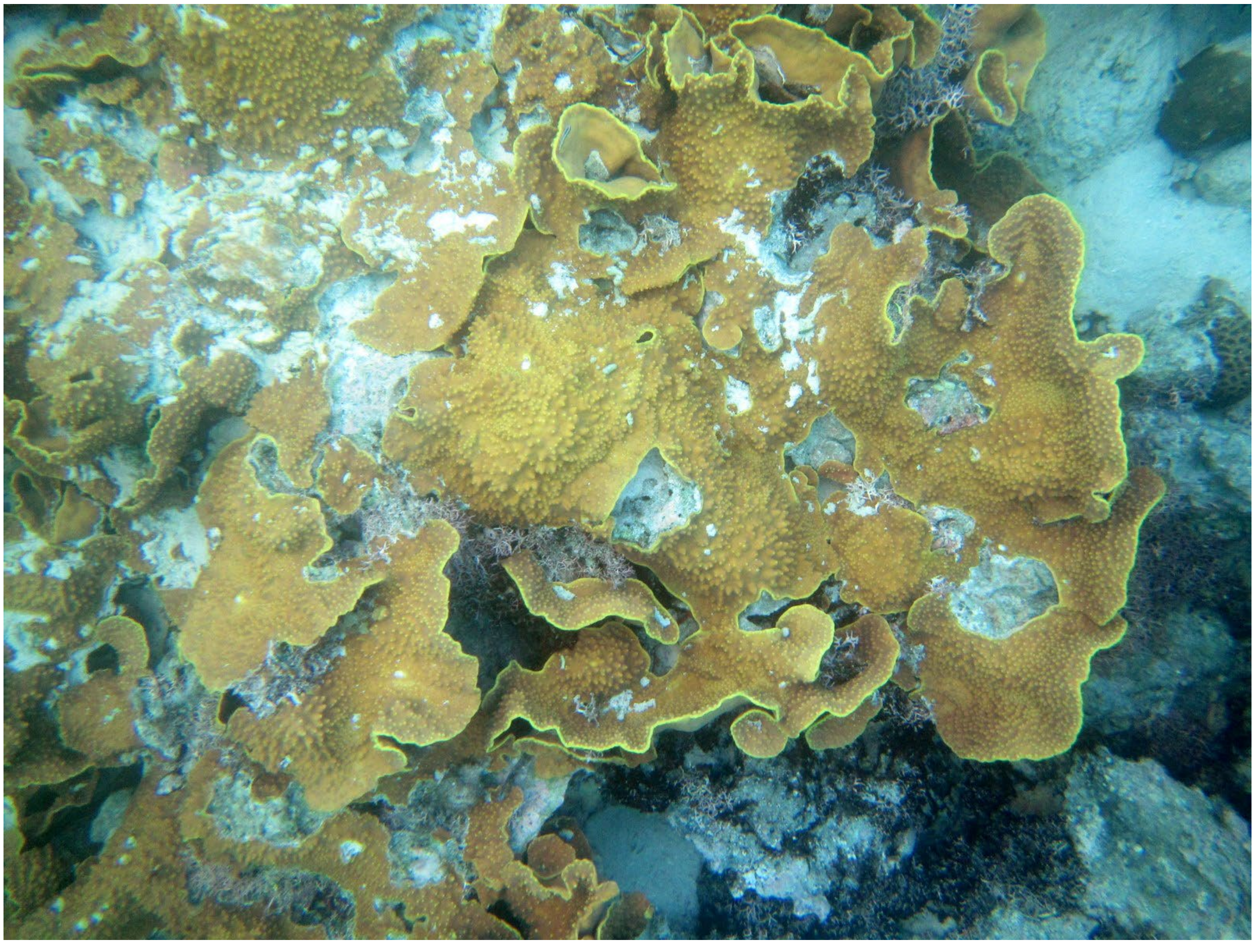
On this colony of *Turbinaria mesenterina*, it is easier to see the smooth undersides of vertical plates than the top sides with polyps.



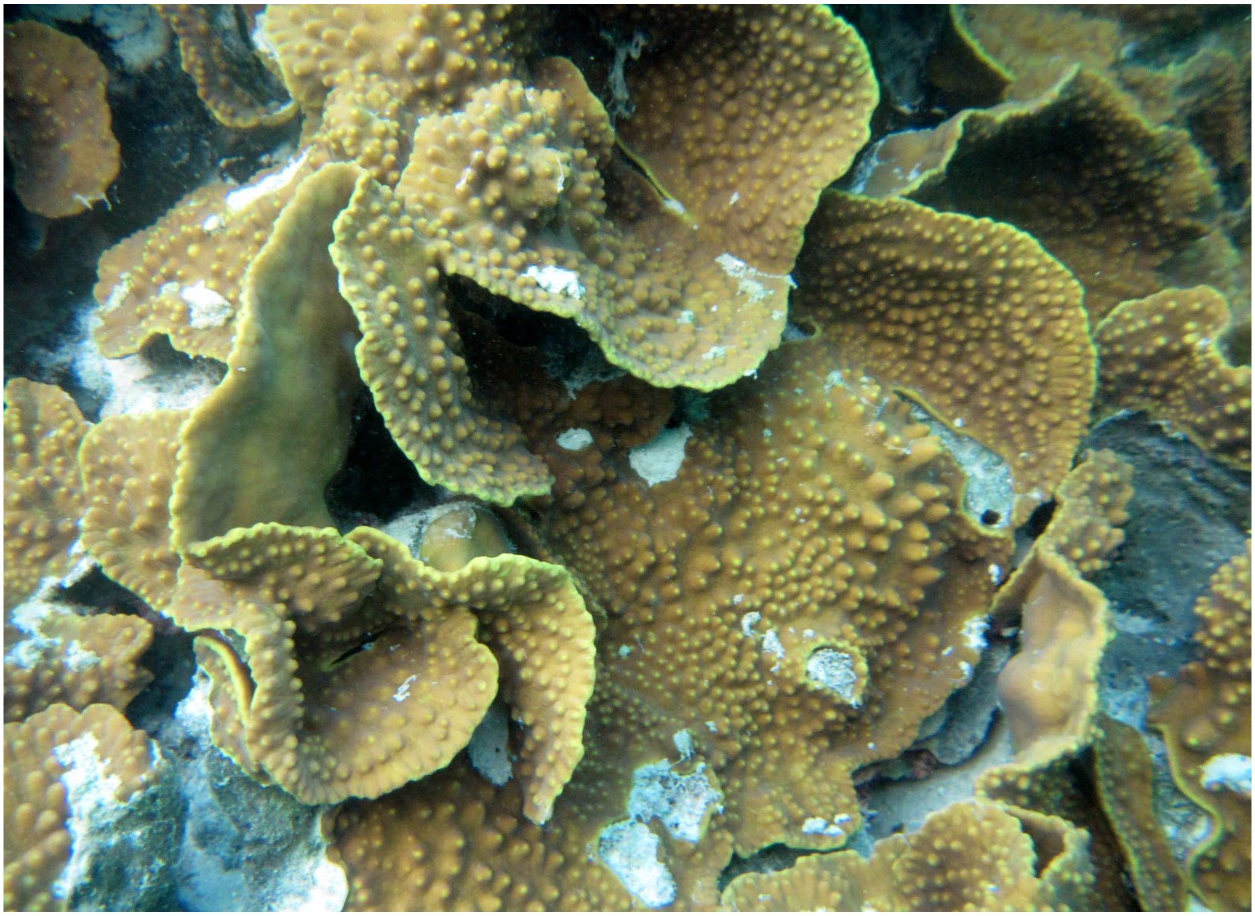
Here the small polyps and corallites can be seen on *Turbinaria mesenterina*.

Turbinaria reniformis Vulnerable EDGE

This species forms colonies made of thin plates that can range from horizontal to vertical, and can make whorls. The polyps are small. Colonies are bright yellow. *Turbinaria mesenterina* is very similar except it is brown.



This colony has encrusting and horizontal areas, and plates that go from horizontal to near vertical.



A close-up photo that shows the corallites. On this colony the polyps were pulled in, but some colonies will have their tentacles extended.

Subclass Octocorallia or Alcyonaria ‘octocorals’

Octocorals have exactly eight tentacles, and each tentacle has small regular side branches called “pini”. Some, called “soft corals,” are very fleshy and can form at least some external skeleton below them that is solid, without corallites. Some (gorgonians) do not form calcium skeletons. The octocorals include all of the soft corals, gorgonians, and sea pens, plus a couple of hard corals, *Heliopora* and *Tubipora*. Both of these have the zooxanthellae single-cell algae in their cells just like the Scleractinia. Many soft corals and gorgonia also have zooxanthellae, but many others do not. *Heliopora* and *Tubipora* do form skeletons of calcium carbonate (aragonite) with a thin tissue layer over them, much like Scleractinia. Soft corals are much fleshier than Scleractinia, but some do produce hard calcium underneath their tissues. They produce tiny knobs of calcium carbonate (aragonite) called “sclerites” in their tissues and move them down slowly and then extrude them beneath them and glue them to what is already there. Many species thus build an undulating smooth platform beneath them, which is as hard as the skeleton of Scleractinia. One species of *Sinularia* builds it in the shape of thick branches that can be up to at least 2 meters tall, and there are a few places in reefs where the reef is made more of this material (called “spiculite”) than skeletons of Scleractinia. Most gorgonians are branching and have a flexible rod in the center of the branch under the thin layer of tissue.

Order Helioporacea or Coenothecalia

There is only one family in this order:

Family Helioporidae

There is only one genus in this family:

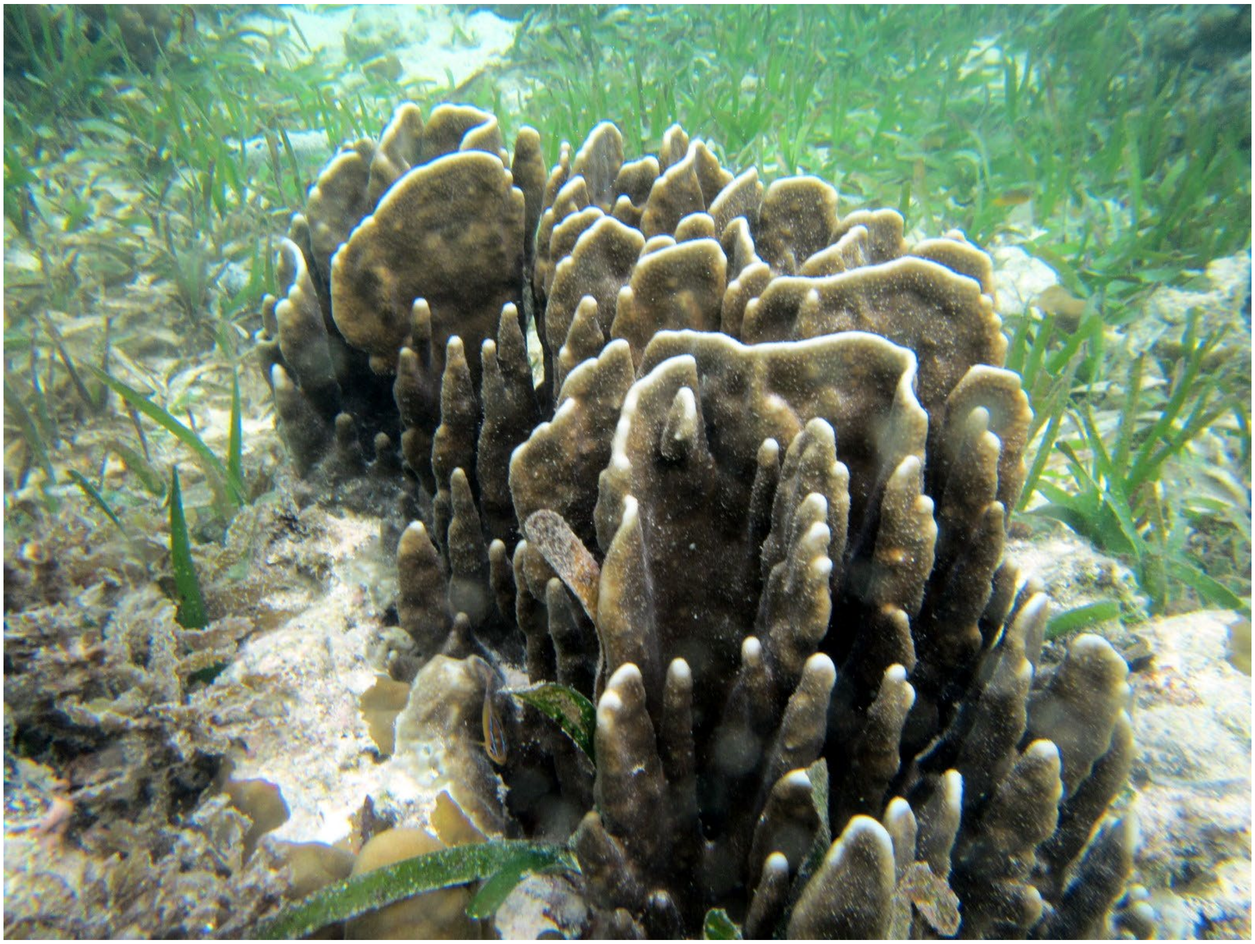
Genus Heliopora

There is only one widespread species in this genus:

Heliopora coerulea “blue coral” Vulnerable

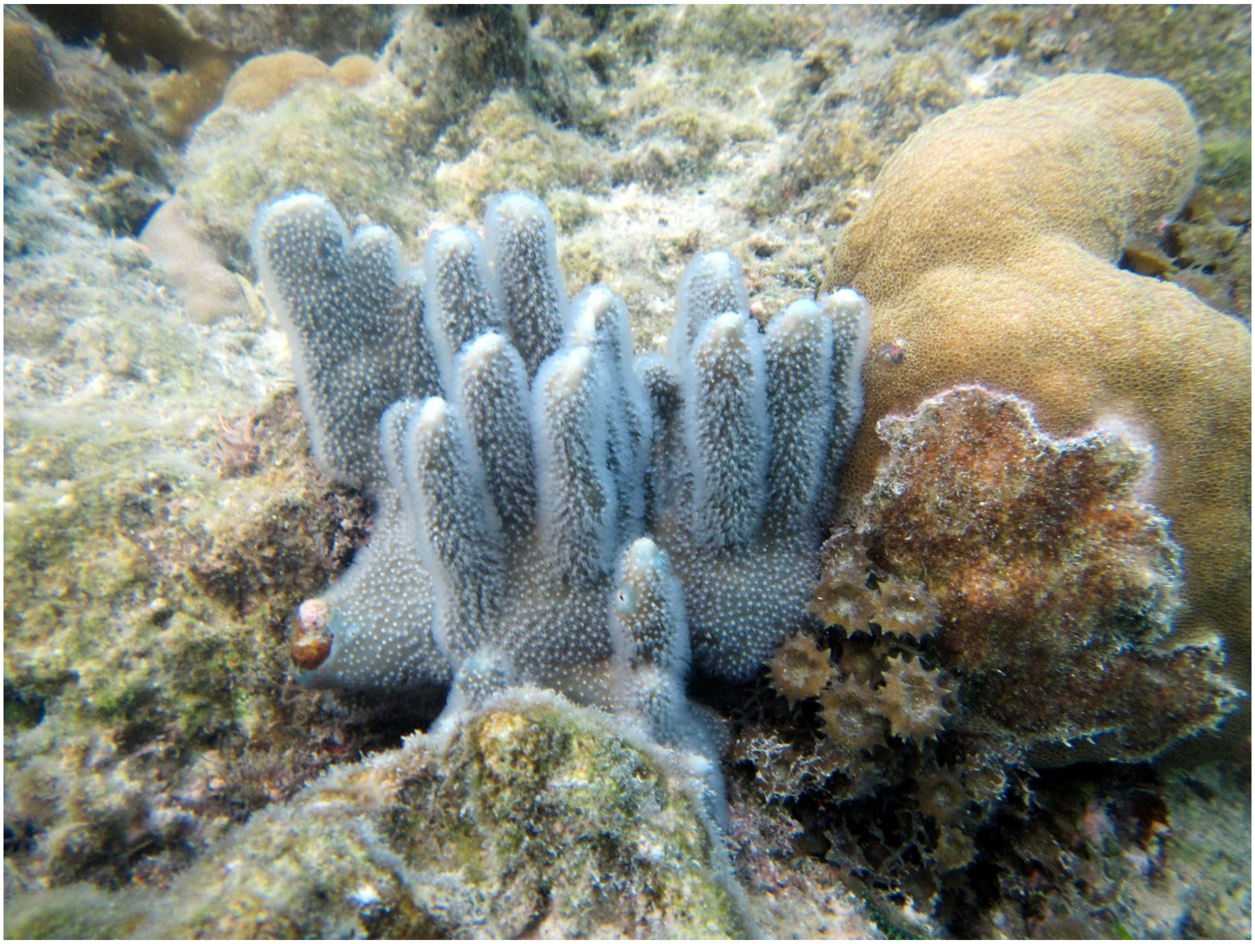
This species produces colonies that have vertical paddles and/or vertical cylindrical columns. It is a member of the “octocorals,” most of which are “soft corals,” but this species produces a hard calcium skeleton like the other hard corals. The skeleton is a dark blue due to the presence of iron salts. Colonies range from blue to brown. This is the only coral with a blue skeleton.

A large colony of *Heliopora coerulea* with paddles and bluish color.



A brown colony of *Heliopora coerulea* with both paddles and columns.

Another colony of *Heliopora coerulea*, this one with slightly blue tips of some of the columns.



A colony of *Heliopora coerulea* that is fuzzy with its polyps extended.

Class Hydrozoa

Class Hydrozoa contains hydroids, some small jellyfish, and several genera that produce hard skeletons, including the last genus presented here. All hydrozoans alternate generations between small polyps which asexually produce medusa (jellyfish), which in turn produce eggs and sperm which when fertilized grow into polyps. The stage that produces the skeletons we see in the next three genera are all colonial polyp stages and produce tiny medusa (about 1 mm diameter or less) that then release eggs and sperm. In some hydrozoa the polyp stage is obvious and the medusa stage less so and in others it is the other way around. The stage that produces the skeletons we see in the next three genera are all colonial polyp stages and produce and release tiny medusa (about 1 mm diameter or less) that then release eggs and sperm.

Order Hydrocorallina "Hydrocorals"

This order contains the forms that produce calcium carbonate (aragonite) skeletons, suborders Milleporina and Stylasterina. One genus (*Millepora*) is zooxanthellate and a common contributor to coral reefs, and several genera are azooxanthellate, only two of which are on coral reefs (*Distichopora* and *Stylaster*) and which tend to be small, in shaded areas, and colorful.

Suborder Milleporina

This suborder has only one and family and genus:

Family Milleporidae

Genus *Millepora* "Fire corals"

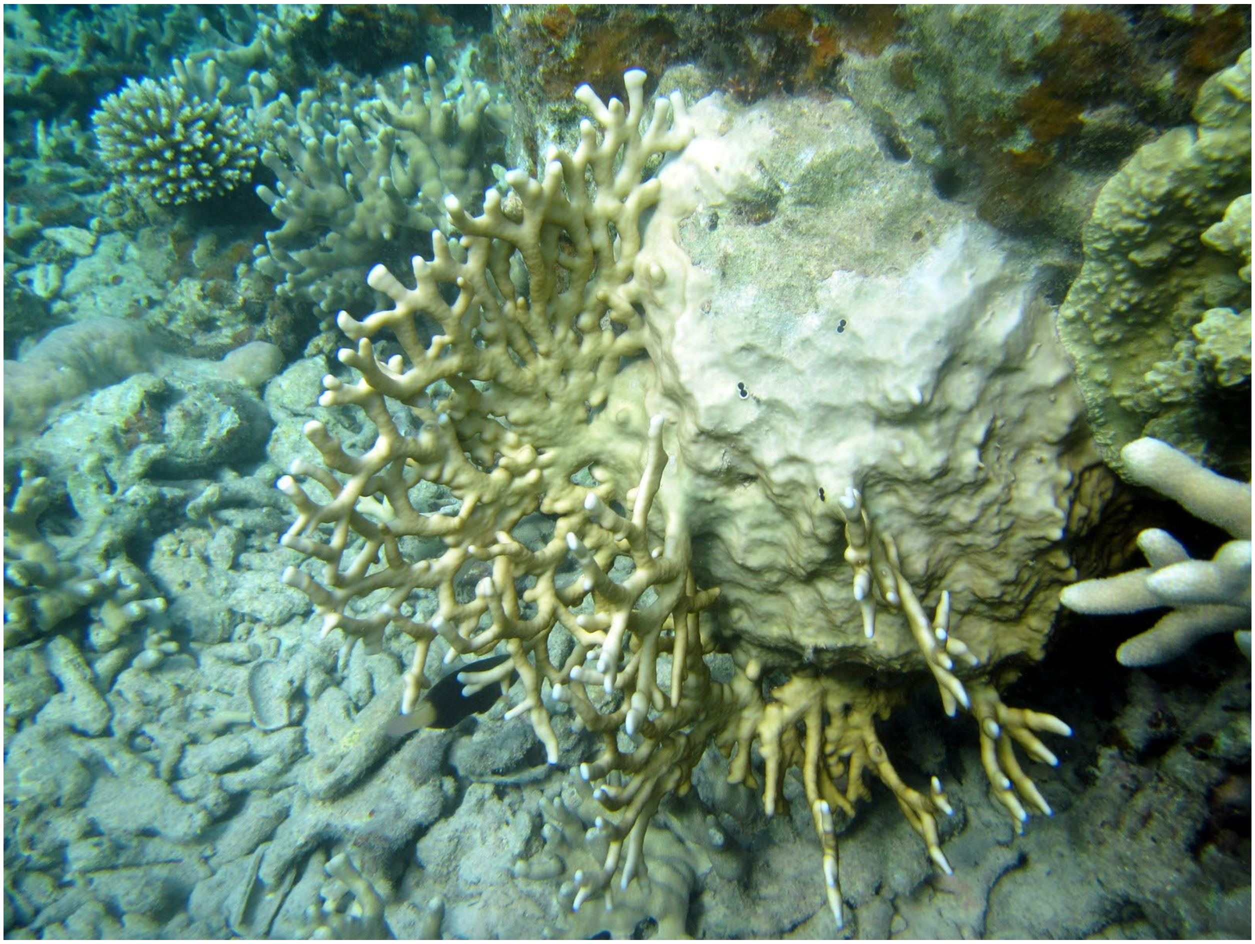
This genus produces a hard skeleton. The living tissue forms tiny, hair-like polyps that sit in tiny pores in the skeleton. The word "millepora" means "thousands of pores" in Latin, which is what the skeleton has, one for each polyp. There are long thin polyps with no mouths for stinging, and short thicker polyps with tiny mouths for eating. The name "*Millepora*" refers to thousands of tiny holes (pores) where the polyps are. *Millepora* species all have the zooxanthellae single-cell algae in their cells and they are found in the light. They evolved the symbiotic relationship with the algae independently of the Scleractinia.

Millepora species are fairly fast growing. Branching species are also some of the most sensitive to mass coral bleaching.

Millepora can be encrusting, encrusting base with vertical paddles, or branching. Surfaces may be smooth or bumpy. Colony shapes are highly variable. It is most often yellow or brown, but can be light green, pink, or, in one species, dark reddish-purple. They have zooxanthellae and are found in light. Touching it with anything but your fingertips will likely give a sting, and it is the only coral that can sting humans. The stings are a brief burning sensation but not serious. They are called "fire corals" because of their sting. Other hydrozoans like the feathery hydroids can sting as well (some more strongly), but they do not have skeleton. The smooth yellow-brown colonies are distinct, and no other hard coral can sting humans.

Millepora dichotoma

This species is branching and commonly forms interlocking branches in the form of a fan, though branches are not always interlocking. Rarely, an encrusting base can be seen. They range from yellow-brown to a light tan. Branches on *Millepora intricata* do not form fans of anastomosing branches.



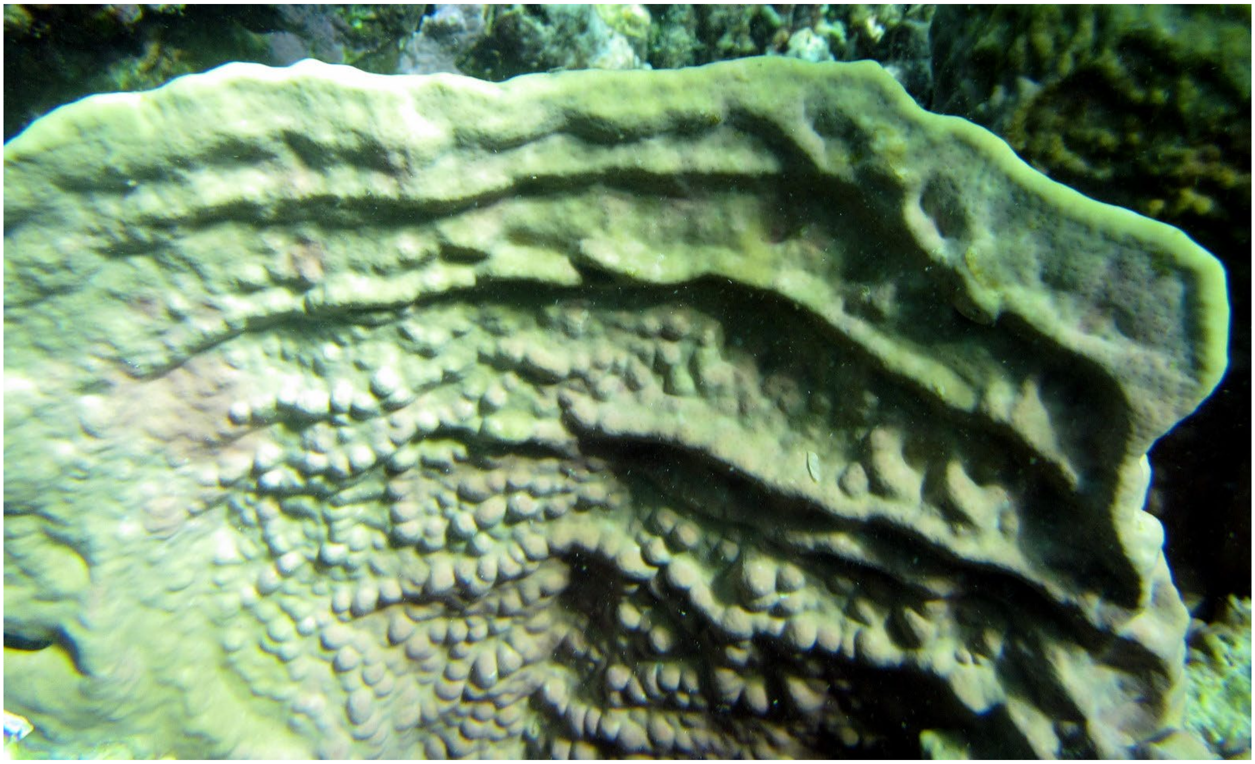
Millepora dichotoma.

A close-up of *Millepora dichotoma*. Corallites cannot be seen as they are too small.

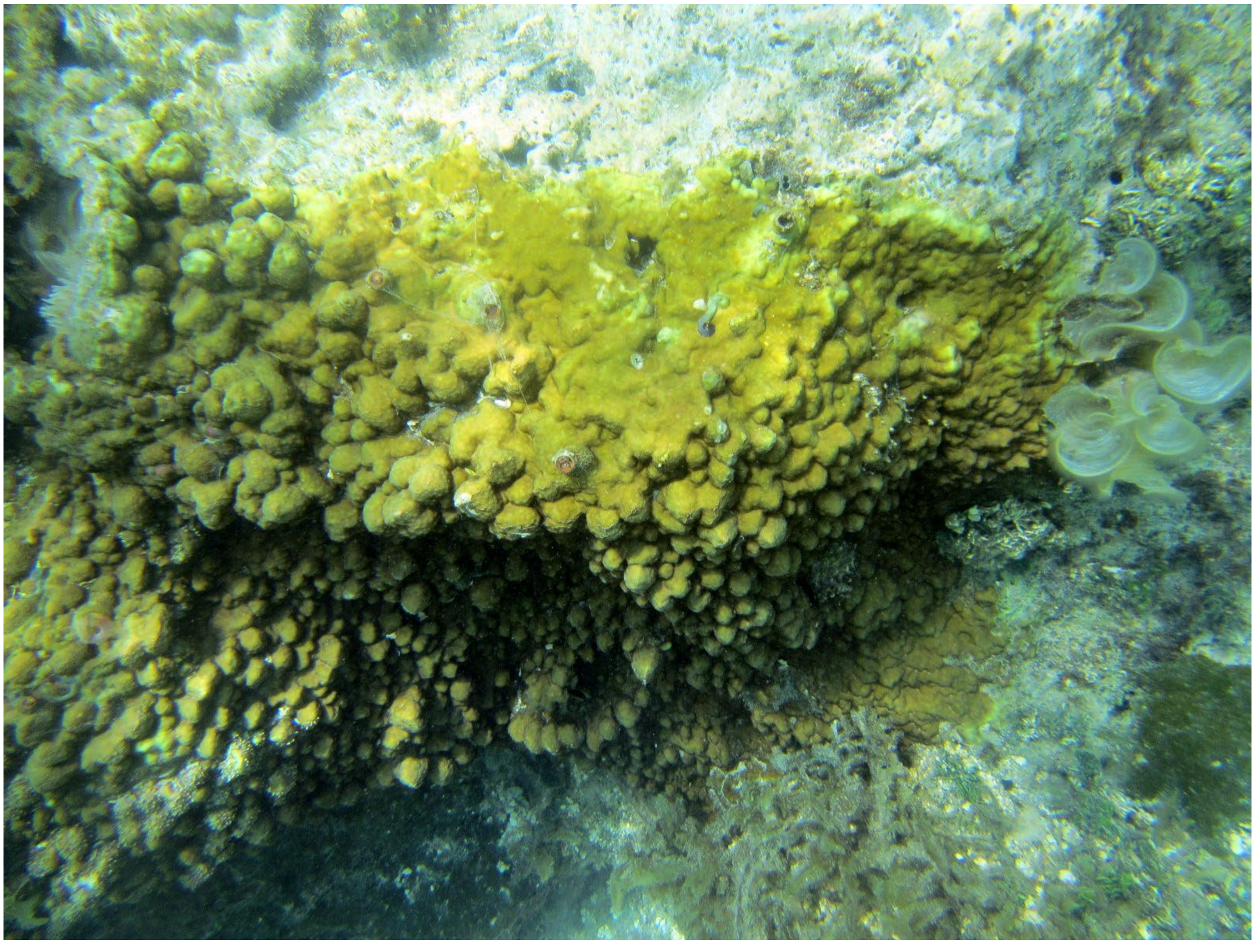
Millepora platyphylla

This species forms encrusting colonies from which vertical plates or paddles commonly grow. The surfaces often have small nodules. This species has a highly variable morphology. Other species of *Millepora* do not form vertical plates or paddles.

A colony of *Millepora platyphylla* showing big vertical plates.



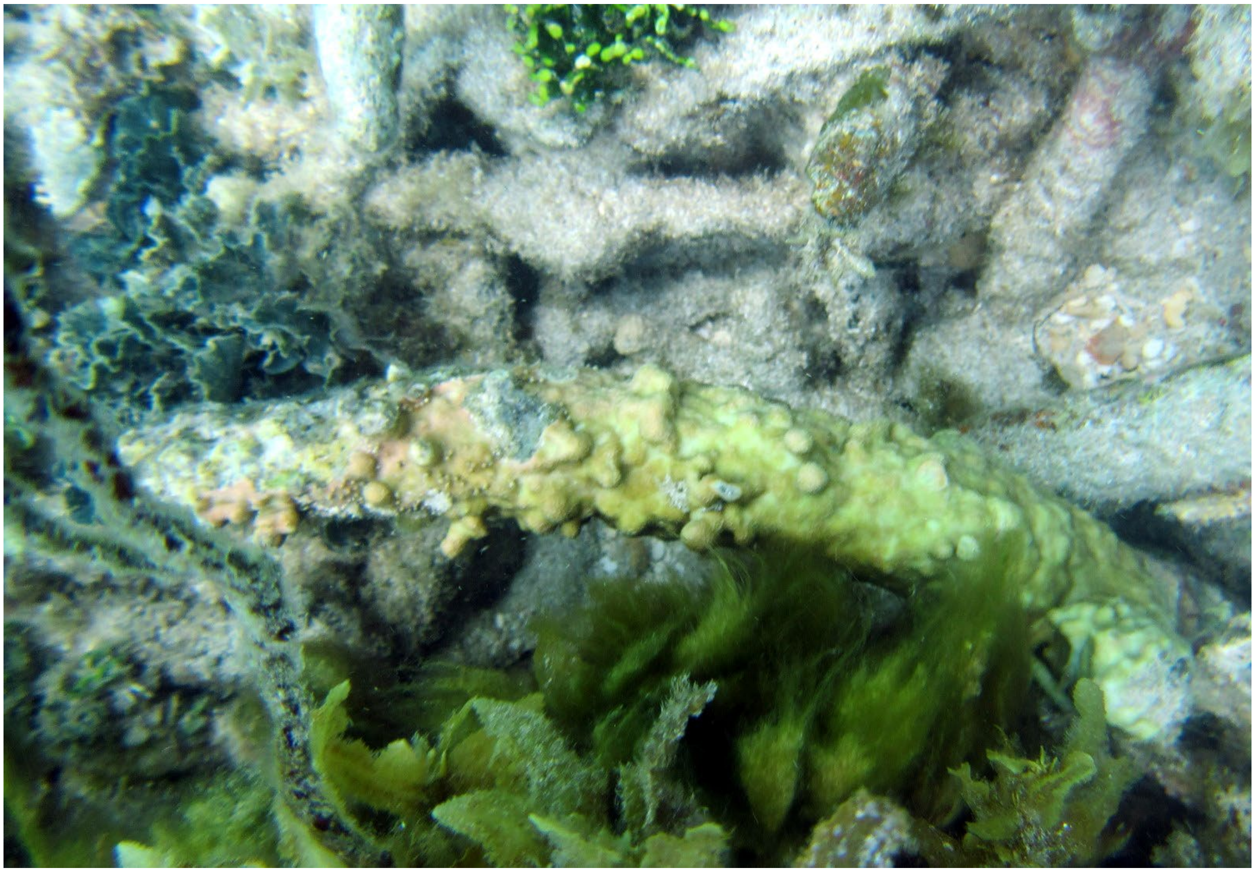
A close-up photo of a plate of *Millepora platyphylla*.



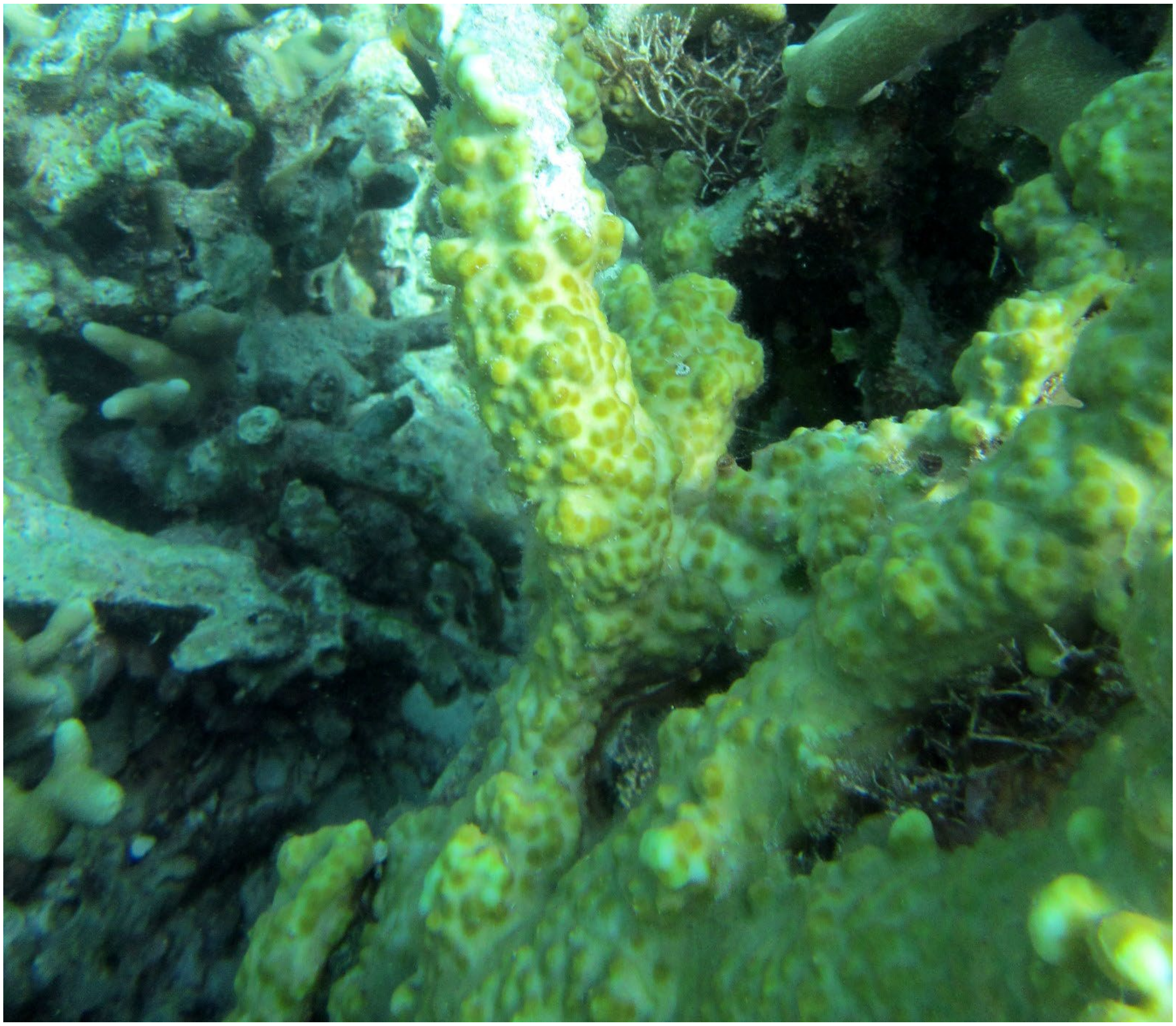
An encrusting colony of *Millepora platyphylla*.

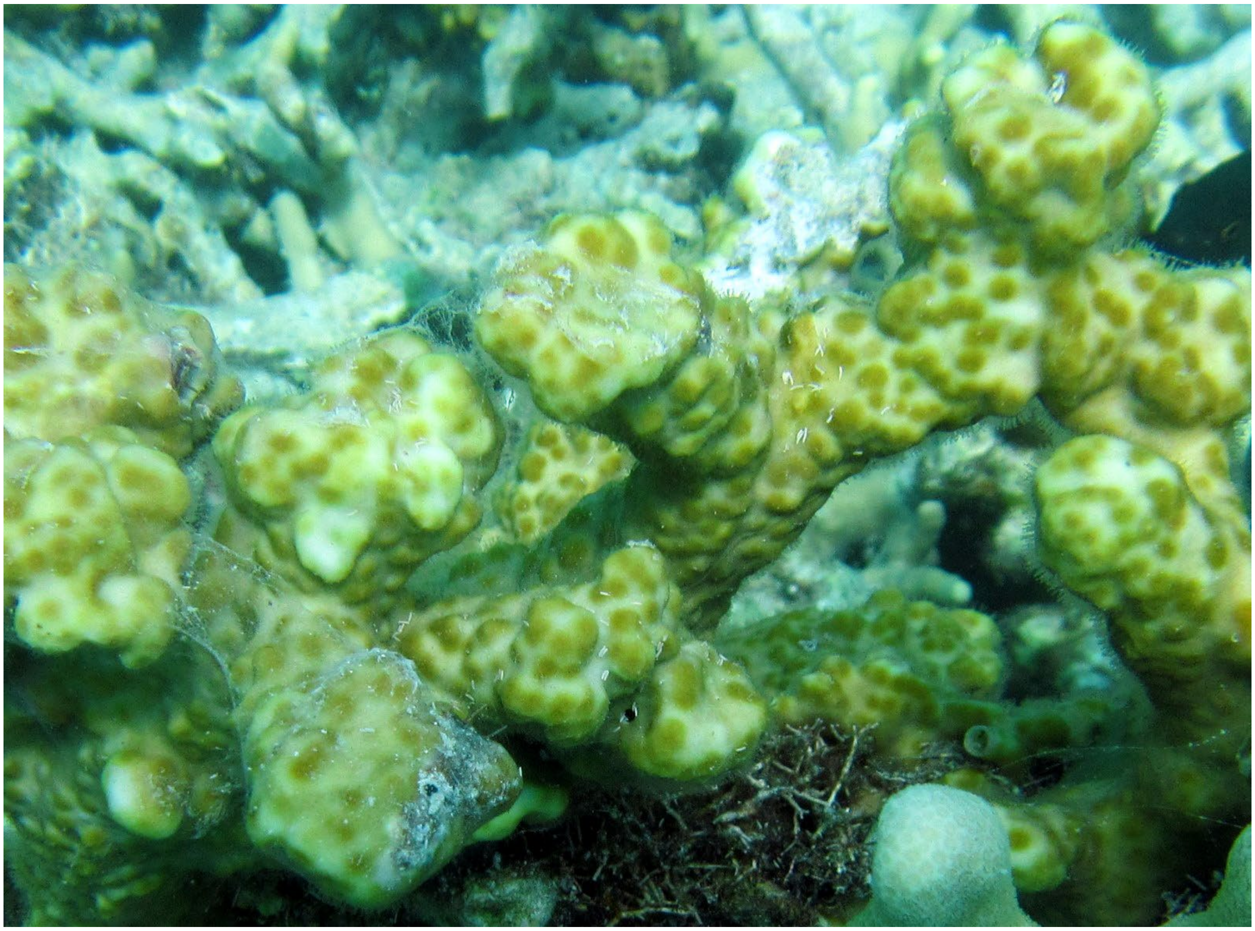
Millepora exaesa

This species forms small encrusting colonies that are often on rubble and in fairly shallow water. Colonies may be lighter colored than *Millepora platyphylla* and/or have larger nodules.



A colony of *Millepora exaesa* encrusting rubble.


A colony of *Millepora exaesa* showing the lumpy surface and spotty pattern.


A close-up photo of *Millepora exesa*.

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The Author

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Born in Michigan, USA, the author has lived in a variety of places in the states, including Florida during his high school years, which stimulated an interest in tropical marine life. During his years at Reed College in Portland, Oregon, he was introduced to biology, including invertebrate biology, studied sea urchin tube feet and respiration for his thesis and spent two summers in Hawaii studying fish behavior with his professors. Once graduated he attended the summer invertebrate zoology course at the Marine Biological Laboratory at Woods Hole, Massachusetts and then another summer was a course assistant for that course. Snorkeling trips to the Caribbean (including to Jamaica just before Hurricane Allen) during graduate school at the University of Pennsylvania were followed by scuba trips to the Caribbean. His coral reef research and publications began with surveys and description of reefs in the Caribbean, including Cozumel, Roatan, Cayman Brac, Little Cayman, and St. Lucia. It became clear that to do transects you need to know your corals, and existing guides were inadequate, so Caribbean coral identification and taxonomy were next to be studied. By this time the author lived in Seattle, Washington. Then the author began to study corals in Hawaii, which led to his identification book for Hawaiian corals. Following that, he worked in the Philippines for two years, learning many coral species in that area of high diversity. This was followed by six years of working with Dr. “Charlie” J.E.N. Veron at the Australian Institute of Marine Science on the “Coral ID” electronic key to corals of the world. At that time, the author began to be invited to study and record corals during Rapid Assessment Programs in a variety of places around the Indo-Pacific. In November, 2003, the author began work at the Dept. Marine & Wildlife Resources, in American Samoa. He began working on coral reef monitoring there a year later and continued with that, and continued to make trips to study corals around the Indo-Pacific. Currently, the author has studied coral at 14 islands in the Caribbean and 14 areas of the Indo-Pacific, plus southern Italy in the Mediterranean. He is an author of 17 book chapters and 46 peer-reviewed articles in scientific journals. He has worked as a contractor for NOAA NMFS Protected Species on the threatened coral species since 2013. That work has taken him around the Pacific each year to study corals and teach people how to identify corals. That effort includes photographing corals, writing field guides and building “practice modules” for teaching coral ID and people to practice with. He currently works on describing new corals species and diseases and a variety of other coral reef topics. He continues to be based in American Samoa.